The New Organon
or: True Directions Concerning the Interpretation of Nature

Francis Bacon

[Brackets] enclose editorial explanations. Small ·dots· enclose material that has been added, but can be read as though it were part of the original text. Occasional •bullets, and also indenting of passages that are not quotations, are meant as aids to grasping the structure of a sentence or a thought. Any four-point ellipsis. . . . indicates the omission of a brief passage that seems to present more difficulty than it is worth. Longer omissions are reported between brackets in normal-sized type. 'Organon' is the conventional title for the collection of logical works by Aristotle, a body of doctrine that Bacon aimed to replace. His title *Novum Organum* could mean 'The New Organon' or more modestly 'A New Organon'; the tone of the writing in this work points to the definite article.

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PREFACE

Those who have taken it on themselves to lay down the law of nature as something that has already been discovered and understood, whether they have spoken in simple confidence or in a spirit of professional posturing, have done great harm to philosophy and the sciences. As well as succeeding in •producing beliefs in people, they have been effective in •squashing and stopping inquiry; and the harm they have done by spoiling and putting an end to other men's efforts outweighs any good their own efforts have brought. Some people on the other hand have gone the opposite way, asserting that absolutely nothing can be known—having reached this opinion through dislike of the ancient sophists, or through uncertainty and fluctuation of mind, or even through being crammed with some doctrine or other. They have certainly advanced respectable reasons for their view; but zeal and posturing have carried them much too far: they haven't •started from true premises or •ended at the right conclusion. The earlier of the ancient Greeks (whose writings are lost) showed better judgment in taking a position between

•one extreme: presuming to pronounce on everything, and

•the opposite extreme: despairing of coming to understand anything.

Often they complained bitterly about how hard investigation is and how dark everything is, and were like impatient horses champing at the bit; but they did pursue their objective and came to grips with nature, apparently thinking that the way to settle this question of whether anything can be known was not by arguing but by trying—·testing, experimenting·. Yet they too, trusting entirely to the power of their intellect, didn't bring any rules to bear and staked everything on hard thinking and continuous mental effort.

My method is hard to practice but easy to explain. I propose to •establish *degrees* of certainty, to •retain ·the evidence of· the senses subject to certain constraints, but mostly to •reject ways of thinking that track along after sensation. In place of that, I open up a new and certain path for the mind to follow, starting from sense-perception. The need for this was felt, no doubt, by those who gave such importance to dialectics; their emphasis on dialectics showed that they were looking for aids to the intellect, and had no confidence in the innate and spontaneous process of the mind. [Bacon's *dialectica*, sometimes translated as 'logic', refers more narrowly to the formalized and rule-governed use of logic, especially in debates.] But this remedy did no good, coming as it did *after* the processes of everyday life had filled the mind with hearsay and debased doctrines and infested it with utterly empty idols. (·I shall explain 'idols' in **39–45** below·.) The upshot was that the art of dialectics, coming (I repeat) too late to the rescue and having no power to set matters right, was only good for fixing errors rather than for revealing truth. [Throughout this work, 'art' will refer to any human activity that involves techniques and requires skills.] We are left with only one way to health—namely to start the work of the mind all over again. In this, the mind shouldn't be left to its own devices, but right from the outset should be guided at every step, as though a machine were in control. My method is hard to practice but easy to explain. I propose to •establish *degrees* of certainty, to •retain ·the evidence of· the senses subject to certain constraints, but mostly to •reject ways of thinking that track along after sensation. In place of that, I open up

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Certainly if in mechanical projects men had set to work with their naked hands, without the help and power of tools, just as in intellectual matters they have set to work with little but the naked forces of the intellect, even with their best collaborating efforts they wouldn't have achieved—or even attempted—much. . . . Suppose that some enormous stone column had to be moved from its place (wanted elsewhere for some ceremonial purpose), and that men started trying to move it with their naked hands, wouldn't any sober spectator think them mad? If they then brought in more people, thinking that that might do it, wouldn't he think them even madder? If they then weeded out the weaker labourers, and used only the strong and vigorous ones, wouldn't he think them madder than ever? Finally, if they resolved to get help from the art of athletics, and required all their workers to come with hands, arms, and sinews properly oiled and medicated according to good athletic practice, wouldn't the onlooker think 'My God, they are trying to show *method* in their madness!'?

Yet that is exactly how men proceed in intellectual matters—with just the same kind of mad effort and useless combining of forces—when they hope to achieve great things either through their individual brilliance or through the sheer number of them who will co-operate in the work, and when they try through dialectics (which we can see as a kind of athletic art) to strengthen the sinews of the intellect. With all this study and effort, as anyone with sound judgment can see, they are merely applying the naked intellect; whereas in any great work to be done by the hand of man the only way to increase the force exerted by each and to co-ordinate the efforts of all is through instruments and machinery.

Arising from those prefatory remarks, there are two more things I have to say; I want them to be known, and not forgotten. ·One concerns ancient *philosophers*, the other concerns modern *philosophy*·.

(1) If I were to declare that I could set out on •the same road as the ancient philosophers and come back with something better than they did, there would be no disguising the fact that I was setting up a rivalry between them and me, inviting a comparison in respect of our levels of excellence or intelligence or competence. There would nothing new in that, and nothing *wrong* with it either, for if the ancients got something wrong, why couldn't I—why couldn't *anyone*—point it out and criticise them for it? But that contest, however right or permissible it was, might have been an unequal one, casting an unfavourable light on my powers. So it is a good thing—good for avoiding conflicts and intellectual turmoil—

that I can leave untouched the honour and reverence due to the ancients, and do what I plan to do while gathering the fruits of my modesty! There won't be any conflict here: my aim is to open up •a new road for the intellect to follow, a road the ancients didn't know and didn't try. I shan't be taking a side or pressing a case. My role is merely that of a guide who points out the road—a lowly enough task, depending more on a kind of luck than on any ability or excellence.

(2) That was a point about persons; the other thing I want to remind you of concerns the topic itself. Please bear this in mind: I'm not even slightly working to overthrow the philosophy [here = 'philosophy and science'] that is flourishing these days, or any other more correct and complete philosophy that has been or will be propounded. I don't put obstacles in the way of this accepted philosophy or others like it; ·let them go on doing what they have long done so well·—let them give philosophers something to argue about, provide decoration for speech, bring profit to teachers of rhetoric and civil servants! Let me be frank about it: the philosophy that I shall be advancing isn't much use for any of *those* purposes. It isn't ready to hand; you can't just pick it up as you go; it doesn't fit with preconceived ideas in a way that would enable it to slide smoothly into the mind; and the vulgar won't ever get hold of it except through its practical applications and its effects. [In this work, 'vulgar' means 'common, ordinary, run-of-the-mill' (as in 'vulgar induction' **17**) or, as applied to people, 'having little education and few intellectual interests'.]

So let there be two sources of doctrine, two disciplines, two groups of philosophers, and two ways of doing philosophy, with the groups not being hostile or alien to each other, but bound together by mutual services. In short, let there be one discipline for cultivating the knowledge we have, and another for discovering new knowledge. This may be pleasant and beneficial for both. Most men are in too much of a hurry, or too preoccupied with business affairs, to engage with my way of doing philosophy—or they don't have the mental powers needed to understand it. If for any of those reasons you prefer the other way—·prefer cultivation to discovery·—I wish you all success in your choice, and I hope you'll get what you are after. But if you aren't content to stick with the knowledge we already have, and want

- •to penetrate further,
- •to conquer nature by works, not conquer an adversary by argument,
- •to look not for nice probable opinions but for sure proven knowledge,

I invite you to join with me, if you see fit to do so. [In this context, 'works' are experiments.] Countless people have stamped around in nature's outer courts; let us get across those and try to find a way into the inner rooms. For ease of communication and to make my approach more familiar by giving it a name, I have chosen to call one of these approaches 'the mind's **anticipation** ·of nature·', the other 'the **interpretation** of nature'. [Throughout this work, 'anticipation' means something like 'second-guessing, getting ahead of the data, jumping the gun'. Bacon means it to sound rash and risky; no one current English word does the job.]

I have one request to make, ·namely that my courtesies towards you, the reader, shall be matched by your courtesies to me·. I have put much thought and care into ensuring that the things I say will be not only true but smoothly and comfortably accepted by •your mind, however clogged •it is by previous opinions. It is only fair—especially in such a great restoration of learning and knowledge—for me to ask a favour in return, namely this: If you are led •by the evidence of your senses, or •by the jostling crowd of 'authorities', or •by arguments in strict logical form (which these days are

respected as though they were the law of the land), to want to pass judgment on these speculations of mine, don't think you can do this casually, while you are mainly busy with something else. Examine the matter thoroughly; go a little distance yourself along the road that I describe and lay out; make yourself familiar with the *subtlety* of things that our experience indicates; give your deeply-rooted bad mental habits a reasonable amount of time to correct themselves; and *then*, when you have started to be in control of yourself, use your own judgment—if you want to. [Bacon doesn't ever in this work address the reader at length. This version sometimes replaces 'If anybody. . . ' by 'If you. . . ', 'Men should. . . ' by 'You should. . . ' and so on, to make the thought easier to follow.]

APHORISMS CONCERNING THE INTERPRETATION OF NATURE: BOOK 1: 1–77

[In **86** below, Bacon explains 'aphorisms' as meaning 'short unconnected sentences, not linked by any method'. His 'aphorisms' vary from three lines to sixteen pages, but his label 'aphorism' will be allowed to stand.]

1. Man, being nature's servant and interpreter, is limited in what he can do and understand by what he has observed of the course of nature—directly observing it or inferring things ·from what he has observed·. Beyond that he doesn't know anything and can't do anything.

2. Not much can be achieved by the naked hand or by the unaided intellect. Tasks are carried through by tools and helps, and the intellect needs them as much as the hand does. And just as the hand's tools either •give motion or •guide it, so ·in a comparable way· the mind's tools either •point the intellect in the direction it should go or • offer warnings.

3. Human knowledge and human power meet at a point; for where the cause isn't known the effect can't be produced. The only way to command nature is to obey it; and something that functions as the •cause in thinking about a process functions as the •rule in the process itself.

4. All that man can do to bring something about is to put natural bodies together or to pull them away from one another. The rest is done by nature working within.

5. The mechanic, the mathematician, the physician, the alchemist and the magician have all rubbed up against nature in their activities; but so far they haven't tried hard and haven't achieved much.

6. If something has never yet been done, it would be absurd and self-contradictory to expect to achieve it other than through means that have never yet been tried.

7. If we go by the contents of •books and by •manufactured products, the mind and the hand seem to have had an enormous number of offspring. But all that variety consists in very fine-grained special cases of, and derivatives from, a few things that were already known; *not* in a large number of fundamental propositions.

8. Moreover, the works that have already been achieved owe more to chance and experiment than to disciplined sciences; for the sciences we have now are merely pretty arrangements of things already discovered, not ways of making discoveries or pointers to new achievements.

9. Nearly all the things that go wrong in the sciences have a single cause and root, namely: while wrongly admiring and praising the powers of the human mind, we don't look for true helps for it.

10. Nature is much subtler than are our senses and intellect; so that all those elegant meditations, theorizings and defensive moves that men indulge in are crazy—except that no-one pays attention to them. [Bacon often uses a word meaning 'subtle' in the sense of 'fine-grained, delicately complex'; no one current English word will serve.]

11. Just as the sciences that we now have are useless for devising new inventions, the logic that we now have is useless for discovering new sciences. [Bacon here uses *inventio* in two of its senses, as = 'invent' and as = 'discover'.]

12. The logic now in use serves to •fix and stabilize errors based on the ideas of the vulgar, rather than to •search for truth. So it does more harm than good.

13. The syllogism isn't brought to bear on the •basic principles of the sciences; it *is* applied to •intermediate axioms, but nothing comes of this because the syllogism is no match for nature's subtlety. It constrains what you can *assent* to, but not what can *happen*.

14. A •syllogism consists of •propositions, which consist of •words, which are stand-ins [*tesserae*, literally = 'tickets'] for •notions. So the root of the trouble is this: If the notions are confused, having been sloppily abstracted from the facts, nothing that is built on them can be firm. So our only hope lies in true induction.

15. There is no soundness in ·our· notions, whether in logic or in natural science. These are not sound notions:

substance, quality, acting, undergoing, being;

And these are even less sound:

heavy, light, dense, rare, moist, dry, generation, corruption, attraction, repulsion, element, matter, form

and so on; all of those are fantastical and ill-defined. ['Rare' = 'opposite of dense'. Generation is the coming into existence of living things; corruption is rotting or falling to pieces, and so refers to the going out of existence of living things. For the next sentence: a 'lowest species' is one that doesn't further divide into subspecies.]

16. ·Our· notions of the lowest species (*man*, *dog*, *dove*) and of the immediate perceptions of the senses (*hot*, *cold*, *black*, *white*) don't seriously mislead us; yet even they are sometimes confusing because of how matter flows and things interact. As for all the other notions that men have adopted—they are mere aberrations, not being caused by things through the right kind of abstraction.

17. The way •axioms are constructed is as wilful and wayward as the abstractions through which •notions are formed. I say this even about the principles that result from vulgar induction, but much more about the axioms and less basic propositions that the syllogism spawns.

18. The discoveries that have been made in the sciences up to now lie close to vulgar notions, scarcely beneath the surface. If we are to penetrate into nature's inner and further recesses, we'll need •a safer and surer method for deriving notions as well as axioms from things, as well as •an altogether better and more certain way of conducting intellectual operations.

19. There are and *can be* only two ways of searching into and discovering truth. **(1)** One of them starts with the senses and particular events and *swoops* straight up from them to the most general axioms; on the basis of these, taken as unshakably true principles, it proceeds to judgment and to the discovery of intermediate axioms. This is the way that people follow now. **(2)** The other derives axioms from the senses and particular events in a gradual and unbroken ascent, ·going *through* the intermediate axioms and· arriving *finally* at the most general axioms. This is the true way, but no-one has tried it.

20. When the intellect is left to itself it takes the same way—namely **(1)**—that it does when following the rules of dialectics. For the mind loves to leap up to generalities and come to rest with them; so it doesn't take long for it to become sick of experiment. But this evil, ·though it is present both in natural science and in dialectics·, is worse in dialectics because of the ordered solemnity of its disputations.

21. When the intellect of a sober, patient, and grave mind is left to itself (especially in a mind that isn't held back by accepted doctrines), it ventures a little way along **(2)** the right path; but it doesn't get far, because without guidance and help it isn't up to the task, and is quite unfit to overcome the obscurity of things.

22. Both ways set out from the senses and particular events, and come to rest in the most general propositions; yet they are enormously different. For one of them **(1)** merely glances in passing at experiments and particular events, whereas the other **(2)** stays among them and examines them with proper respect. One **(1)** proceeds immediately to laying down certain abstract and useless generalities, whereas the other **(2)** rises by step by step to what is truly better known by nature. [In calling something 'known to nature' Bacon means that it is a general law of nature; 'better known by nature' could mean 'a more general law of nature' or 'a generality that is more completely lawlike'.]

23. There is a great difference between •the *idols* of the human mind and •the *ideas* of God's mind—that is, between •certain empty beliefs and •the true seals [= 'signs of authenticity'] and marks that we have found in created things.

24. There's no way that axioms •established by argumentation could help us in the discovery of new things, because the subtlety of nature is many times greater than the subtlety of argument. But axioms •abstracted from particulars in the proper way often herald the discovery of new particulars and point them out, thereby returning the sciences to their active status.

25. The axioms that are now in use are mostly made so that they *just* cover the items from which they arise, namely thin and common-or-garden experiences and a few particulars of the commonest sorts, so it is no wonder if they don't lead to new particulars. ·And it's not only the axioms, but also the way they are handled, that is defective·. If some unexpected counter-example happens to turn up, the axiom is rescued and preserved by some frivolous distinction, rather than (the truer course) being amended.

26. To help me get my ideas across, I have generally used different labels for human reason's two ways of approaching nature: the customary way I describe as *anticipating nature* (because it is rash and premature) [see note on 'anticipation' on page 3 above]; and the way that draws conclusions from facts in the right way I describe as *interpreting* nature.

27. Anticipations are a firm enough basis for consent, for even if men all went mad in the same way they might agree one with another well enough.

28. Indeed, anticipations have much more power to win assent than interpretations do. They are inferred from a few instances, mostly of familiar kinds, so that they immediately brush past the intellect and fill the imagination; whereas interpretations are gathered from very various and widely dispersed facts, so that they can't suddenly strike the intellect, and must seem weird and hard to swallow—rather like the mysteries of faith.

29. Anticipations and dialectics have their place in sciences based on opinions and dogmas, because in those sciences the aim is to be master of •what people believe but not of •the facts.

30. Even if all the brains of all the ages come together, collaborate and share their results, no great progress will ever be made in science by means of anticipations. That is because errors that are rooted in the first moves that the mind makes can't be cured later on by remedial action, however brilliant.

31. It is pointless to expect any great advances in science from grafting new things onto old. If we don't want to go around in circles for ever, making 'progress' that is so small as be almost negligible, we must make a fresh start with deep foundations. ['Fresh start' translates *instauratio*, from the verb *instauro* = 'make a fresh start (on a ceremony that has been wrongly performed)'. Bacon planned a six-part work on science and its philosophy and methods, which he called his *Instauratio magna*—his Great Fresh

Start. There are other informal mentions of fresh starts in **38** and **129**, and the Great Fresh Start is referred to in **92** and each of **115**–**117**. Bacon died six years after publishing the present work. It is Part 2 of the Great Fresh Start, and the only Part he completed.]

32. This is not to attack the honour of the ancient authors or indeed of anyone else, because I am comparing not •intelligences or •competences but •ways ·of proceeding in the sciences·; and the role I have taken on is that of a guide, not a judge.

33. This must be said outright: anticipations (the kind of reasoning that is now in use) can't pass judgment on my method or on discoveries arising from it; for I can't be called on to submit to the sentence of a tribunal which is itself on trial!

34. It won't be easy for me to deliver and explain my message, for things that are in themselves *new* will be understood on analogy with things that are *old*.

35. Borgia said that when the French marched into Italy they came with chalk in their hands to •mark out their lodgings, not with weapons to •force their way in. Similarly, I want my doctrine to enter quietly into the minds that are fit to receive it and have room for it. ·Forcing my way in with weapons, so to speak, won't work· because refutations—·and more generally *arguments* pro and con·—can't be employed when what's at stake is a difference of view about first principles, notions, and even forms of demonstration.

36. There remains for me only one way of getting my message across. It is a simple way, namely this: I must lead you to the particular events themselves, and to the order in which they occur; and you for your part must force yourself for a while to lay aside your •notions and start to familiarize yourself with •facts.

37. Those who deny that anything can be known for sure •start off their thinking in something like my way, but where they •end up is utterly different from and opposed to where I end up. They say that *nothing can be known*, period. I say that *not much can be known about nature by the method that is now in use*. And then they go on to destroy the authority of the senses and the intellect, whereas I devise and supply helps for them.

38. The idols and false notions that now possess the human intellect and have taken deep root in it don't just •occupy men's minds so that truth can hardly get in, but also when a truth *is* allowed in they will •push back against it, stopping it from contributing to a fresh start in the sciences. This can be avoided only if men are forewarned of the danger and do what they can to fortify themselves against the assaults of these idols and false notions.

39. There are four classes of idols that beset men's minds, and to help me in my exposition I have given them names. I call the first class **idols of the tribe**, the second **idols of the cave**, the third **idols of the market place**, and the fourth **idols of the theatre**.

40. The proper way to keep idols at bay and to drive them off is, no doubt, to form ideas and axioms by true induction. But it is very useful just to point the idols out; for •the truth about the idols serves •the interpretation of nature in the way that •the truth about argumentative fallacies serves •ordinary logical argumentation.

41. The **idols of the tribe** have their foundation in human nature itself—in the tribe known as 'mankind'. It is not true that the human senses are the measure of things; for all perceptions—of the senses as well as of the mind—reflect the perceiver rather than the world. The human intellect is like a distorting mirror, which receives light-rays irregularly and

so mixes its own nature with the nature of things, which it distorts.

42. The **idols of the cave** are the idols of the individual man. In addition to the errors that are common to human nature in general, everyone has his own personal cave or den that breaks up and corrupts the light of nature. This may come from factors such as these:

- •his own individual nature,
- •how he has been brought up and how he interacts with others,
- •his reading of books and the influence of writers he esteems and admires,
- •differences in how his environment affects him because of differences in his state of mind—whether it is busy thinking about something else and prejudiced against this intake or calm and open-minded.

So that the human spirit is distributed among individuals in ways that make it variable and completely disorderly—almost a matter of luck. Heraclitus was right: men look for sciences in ·their own individual· lesser worlds, and not in the greater world that they have in common.

43. There are also idols formed by men's agreements and associations with each other (·I have in mind especially the agreements that fix the meanings of words·). I call these **idols of the market place**, because that is where men come together and do business. ·Such transactions create idols· because •men associate by talking to one another, and •the uses of words reflect common folks' ways of thinking. It's amazing how much the intellect is hindered by wrong or poor choices of words. The definitions or explanations that learned men sometimes use to protect themselves ·against such troubles· don't at all set the matter right: words plainly force and overrule the intellect, throw everything into confusion, and lead men astray into countless empty disputes and idle fancies.

44. Lastly, there are idols that have come into men's minds from various philosophical dogmas and from topsy-turvy laws of demonstration. I call these **idols of the theatre**, because I regard every one of the accepted systems as the staging and acting out of a fable, making a fictitious staged world of its own. I don't say this only about the systems that are currently fashionable, or only about the ancient sects and philosophies; many other fables of the same kind may still be written and produced, seeing that errors can be widely different yet have very similar causes. And I'm saying this not only about whole systems but also about a good many principles and axioms in ·individual· sciences—ones that have gathered strength through tradition, credulity, and negligence. But these various kinds of idols will have to be discussed more clearly and at greater length if the human intellect is to be adequately warned against them. ·I'll start with the idols of the tribe, which will be my topic until the end of **52**·.

45. The human intellect is inherently apt to •suppose the existence of more order and regularity in the world than it •finds there. Many things in nature are unique and not like anything else; but the intellect devises for them non-existent parallells and correspondences and relatives. That is how it comes about •that all the heavenly bodies are thought to move in perfect circles. . . ., •that fire. . . .has been brought in as one of the elements, to complete the square with the other three elements—·earth, air, water·—which the senses detect, and •that the 'elements' (as they are called) are arbitrarily said to differ in density by a factor of ten to one. And so on for other dreams. And these fancies affect not only ·complex· propositions but also simple notions.

46. Once a human intellect has adopted an opinion (either as something it *likes* or as something generally accepted), it draws everything else in to confirm and support it. Even if there are more and stronger instances against it ·than there are in its favour·, the intellect either •overlooks these or •treats them as negligible or •does some line-drawing that lets it shift them out of the way and reject them. This involves a great and pernicious prejudgment by means of which the intellect's former conclusions remain inviolate.

> A man was shown a picture, hanging in a temple, of people who had made their vows and escaped shipwreck, and was asked '*Now* do you admit the power of the gods?' He answered with a question: 'Where are the pictures of those who made their vows and then drowned?'

It was a good answer! That's how it is with all superstition—involving astrology, dreams, omens, divine judgments, and the like, Men get so much pleasure out of such vanities that they notice the •confirming events and inattentively pass by the more numerous •disconfirming ones. This mischief insinuates itself more subtly into philosophy and the sciences: there, when a proposition has found favour it colours other propositions and brings them into line with itself, even when they ·in their undisguised form· are sounder and better than it is. Also, apart from the pleasure and vanity that I have spoken of, the human intellect is perpetually subject to the special error of being moved and excited more by affirmatives than by negatives; whereas it *ought* to have the same attitude towards each. Indeed, when it is a matter of establishing a true axiom, it's the negative instance that carries more force.

47. The greatest effect on •the human intellect is had by things that strike and enter the mind simultaneously and unexpectedly; it is these that customarily fill—*inflate*!—the imagination; and then •it feigns and supposes that everything else is somehow, though •it can't see how, similar to those few things that have taken it by storm. ['Feign' translates the Latin *fingo*, which is the source for the English word 'fiction'.] But the intellect is altogether slow and unfit for the journey to distant and heterogeneous instances which put axioms to the test—like testing something by fire—unless it is forced to do so by severe laws and overruling authority.

48. The human intellect is never satisfied; it can't stop or rest, and keeps searching further; but all to no purpose. That's why we can't conceive of any end or limit to the world—why we always virtually *have* to have the thought of something beyond ·any candidate for the role of world's end·. And we can't conceive, either, of how eternity has flowed down to the present day. ·A plausible story about this says that time is infinite in both directions, and the present is just a point along this infinite line. But· the commonly accepted idea of infinity in time past and in time to come can't be sustained, for it implies that •one infinity is greater than another, and that •one infinity is getting used up and tending to become finite. The infinite divisibility of lines is a source of a similar network of difficulties arising from our thought's inability ·to reach a resting-place·. But this inability interferes even worse in the discovery of causes, ·and here is how·.

> The most general principles in nature have to be brute facts, just as they are discovered, and can't be derived from any ·still more general or basic· cause. Yet the restless human intellect still looks for something
>
> **Latin:** *notiora* = 'better known'
> **probably short for:** *natura notiora* = 'better known to nature'
> **actually meaning:** 'more general and/or basic' [see note in **22**]—·something to explain why they are true·.

> Then in that ·doomed· struggle for something further off, it ·finds itself defeated, and instead· falls back on something that is nearer at hand, namely on *final causes*—·i.e. on the notion of what a principle is *for*, what *purpose* explains its being true·. Science has been enormously messed up by this appeal to final causes, which obviously come from the nature of man rather than from the nature of the world—·that is, which project the scientist's own purposes *onto* the world rather than finding purposes *in* it·.

To look for causes of the most general principles is to do science in an ignorant and frivolous way—just as much as *not* looking for causes of subordinate and less general truths.

49. The human intellect doesn't burn with a dry [here = 'uncontaminated'] light, because what the person *wants* and *feels* gets pumped into it; and that is what gives rise to the 'please-yourself sciences'. For a man is more likely to believe something if he would like it to be true. Therefore he rejects

- •difficult things because he hasn't the patience to research them,
- •sober and prudent things because they narrow hope,
- •the deeper things of nature, from superstition,
- •the light that experiments can cast, from arrogance and pride (not wanting people to think his mind was occupied with trivial things),
- •surprising truths, out of deference to the opinion of the vulgar.

In short, there are countless ways in which, sometimes imperceptibly, a person's •likings colour and infect his •intellect.

50. But what contributes most to the blockages and aberrations of the human intellect is the fact that the ·human· senses are dull, incompetent and deceptive. The trouble is this: things that strike the senses outweigh other things—more important ones—that don't immediately strike them. That is why people stop *thinking* at the point where their *eyesight* gives out, paying little or no attention to •things that can't be seen—for example, all the •workings of the spirits enclosed in tangible bodies. Nor do they pay attention to all the subtler changes of microstructure in the parts of coarser substances (which are vulgarly called 'alterations' though they are really extremely small-scale •movements). And yet unless these two things—·the workings of spirits, and subtle changes of form in bodies·—can be searched out and brought into the light, nothing great can be achieved in nature in the way of practical applications. A third example: the essential nature of our common air, and of all the many bodies that are less dense than air, is almost unknown. For the senses by themselves are weak and unreliable; and instruments for extending or sharpening them don't help much. All the truer kind of *interpretation* of nature comes about through instances and well-designed experiments: the senses pass judgment on the experiment, and the experiment passes judgment on nature, on the facts.

[Bacon's many uses of the word *schematismus* show that for him a body's *schematismus* is its fine-grained structure. This version will always use 'microstructure', but be aware that Bacon doesn't use a word with the prefix 'micro'. •Also, here and throughout, 'spirits' are extremely finely divided gases or fluids, *not* mental items of any kind.] **51.** The human intellect is inherently prone to make abstractions, and it feigns an unchanging essence for things that are in flux. But better than •abstracting from nature is •dissecting it; which is what Democritus and his followers did, getting deeper into nature than anyone since. What we should be attending to is *matter*, its microstructures and changes of microstructure, and *actus purus*, and the laws of action or

motion. ·The alternative to studying *matter* is to study *forms*, but· forms are fabrications of the human mind, unless you want to call the laws of action 'forms'. [Bacon doesn't explain *actus purus*. In each of its other three occurrences he connects it with *laws*, and his meaning seems to be something like: 'the laws governing the pure actions of individual things, i.e. the things they do because of their own natures independently of interference from anything else'. If x does A partly because of influence from something else y, then x is not purely •active in respect of A because y's influence gives A a certain degree of •passivity. From here on, *actus purus* will be translated by 'pure action'.]

52. Those, then, are the idols of the tribe, as I call them—the idols that ·arise from human nature as such. More specifically, they· arise from the human spirit's •regularity of operation, or its •prejudices, or its •narrowness, or its •restlessness, or •input from the feelings, or from the •incompetence of the senses, or from •the way the senses are affected.

53. The idols of the cave—·my topic until the end of **58**·—arise from the particular mental and physical make-up of the individual person, and also from upbringing, habits, and chance events. There are very many of these, of many different kinds; but I shall discuss only the ones we most need to be warned against—the ones that do most to disturb the clearness of the intellect.

54. A man will become attached to one particular science and field of investigation either because •he thinks he was its author and inventor or because •he has worked hard on it and become habituated to it. But when someone of this kind turns to *general* topics in philosophy ·and science· he wrecks them by bringing in distortions from his former fancies. This is especially visible in Aristotle, who made his natural science a mere bond-servant to his logic, rendering it contentious and nearly useless. The chemists have taken a few experiments with a furnace and made a fantastic science out of it, one that applies to hardly anything. . . .[In this work 'chemists' are alchemists. Nothing that we would recognize as chemistry existed.]

55. When it comes to philosophy and the sciences, minds differ from one another in one principal and fairly radical way: some minds have more liking for and skill in •noting differences amongst things, others are adapted rather to •noting things' resemblances. The •steady and acute mind can concentrate its thought, fixing on and sticking to the subtlest distinctions; the •lofty and discursive mind recognizes and puts together the thinnest and most general resemblances. But each kind easily goes too far: one by •grasping for ·unimportant· differences between things, the other by •snatching at shadows.

56. Some minds are given to an extreme admiration of antiquity, others to an extreme love and appetite for novelty. Not many have the temperament to steer a middle course, not pulling down sound work by the ancients and not despising good contributions by the moderns. The sciences and philosophy have suffered greatly from this, because these attitudes to antiquity and modernity are not *judgments* but mere *enthusiasms*. Truth is to be sought not in •what people like or enjoy in this or that age, but in •the light of nature and experience. The •former is variable, the •latter is eternal. So we should reject these enthusiasms, and take care that our intellect isn't dragged into them.

57. When you think ·hard and long and uninterruptedly· about nature and about bodies in their simplicity—·i.e. think of topics like *matter as such*·—your intellect will be broken up and will fall to pieces. When on the other hand you think ·in the same way· about nature and bodies in all their

complexity of structure, your intellect will be stunned and scattered. The difference between the two is best seen by comparing the school of Leucippus and Democritus with other philosophies. For the members of that school were so busy with the ·general theory of· particles that they hardly attended to the structure, while the others were so lost in admiration of the structure that they didn't get through to the simplicity of nature. What we should do, therefore, is alternate between these two kinds of thinking, so that the intellect can become *both* penetrating *and* comprehensive, avoiding the disadvantages that I have mentioned, and the idols they lead to.

58. Let that kind of procedure be our prudent way of keeping off and dislodging the idols of the cave, which mostly come from

- ·intellectual· favouritism (**54**),
- an excessive tendency to compare or to distinguish (**55**),
- partiality for particular historical periods (**56**), or
- the largeness or smallness of the objects contemplated (**57**).

Let every student of nature take this as a general rule for helping him to keep his intellect balanced and clear: when your mind seizes on and lingers on something with special satisfaction, treat it with suspicion!

59. The idols of the market place are the most troublesome of all—idols that have crept into the intellect out of the contract concerning words and names [Latin *verborum et nominum*, which could mean 'verbs and nouns'; on the contract, see **43**]. Men think that their reason governs words; but it is also true that words have a power of their own that reacts back onto the intellect; and this has rendered philosophy and the sciences sophistical and idle. Because words are usually adapted to the abilities of the vulgar, they follow the lines of division that are most obvious to the vulgar intellect. When a language-drawn line is one that a sharper thinker or more careful observer would want to relocate so that it suited the true divisions of nature, words stand in the way of the change. That's why it happens that when learned men engage in high and formal discussions they often end up arguing about words and names, using definitions to sort them out—thus •ending where, according to mathematical wisdom and mathematical practice, it would have been better to •start! But when it comes to dealing with natural and material things, definitions can't cure this trouble, because the definitions themselves consist of words, and those words beget others. So one has to have recourse to individual instances. . . .

60. The idols that words impose on the intellect are of two kinds. (1) There are names of things that don't exist. Just as there are things with no names (because they haven't been observed), so also there are names with no things to which they refer—these being upshots of fantastic ·theoretical· suppositions. Examples of names that owe their origin to false and idle theories are 'fortune', 'prime mover', 'planetary orbits', and 'element of fire'. This class of idols is fairly easily expelled, because you can wipe them out by steadily rejecting and dismissing as obsolete all the theories ·that beget them·.

(2) Then there are names which, though they refer to things that do exist, are confused and ill-defined, having been rashly and incompetently derived from realities. Troubles of this kind, coming from defective and clumsy abstraction, are intricate and deeply rooted. Take the word 'wet', for example. If we look to see how far the various things that are called 'wet' resemble one other, we'll find that 'wet' is nothing but than a mark loosely and confusedly used to label a variety of states of affairs that can't be unified through

any constant meaning. For something may be called 'wet' because it

- •easily spreads itself around any other body,
- •has no boundaries and can't be made to stand still,
- •readily yields in every direction.
- •easily divides and scatters itself,
- •easily unites and collects itself,
- •readily flows and is put in motion,
- •readily clings to another body and soaks it,
- •is easily reduced to a liquid, or (if it is solid) easily melts.

Accordingly, when you come to apply the word, if you take it in one sense, flame is wet; if in another, air is not wet; if in another, fine dust is wet; if in another, glass is wet. So that it is easy to see that the notion has been taken by abstraction only from water and common and ordinary liquids, without proper precautions.

Words may differ in *how* distorted and wrong they are. One of the •least faulty kinds is that of names of substances, especially names that

- •are names of lowest species, ·i.e. species that don't divide into sub-species·, and
- •have been *well* drawn ·from the substances that they are names of·.

·The drawing of substance-names and -notions from the substances themselves *can* be done well or badly. For example·, our notions of chalk and of mud are good, our notion of earth bad. •More faulty are names of events: 'generate', 'corrupt', 'alter'. •The most faulty are names of qualities: 'heavy', 'light', 'rare', 'dense', and the like. (I exclude from this condemnation names of qualities that are immediate objects of the senses.) Yet in each of these categories, inevitably some notions are a little better than others because more examples of them come within range of the human senses.

61. The idols of the theatre ·which will be my topic until the end of **68**· are not innate, and they don't steal surreptitiously into the intellect. Coming from the fanciful stories told by philosophical theories and from upside-down perverted rules of demonstration, they are openly proclaimed and openly accepted. Things I have already said imply that there can be no question of *refuting* these idols: where there is no agreement on premises or on rules of demonstration, there is no place for argument.

·An aside on the honour of the ancients·

This at least has the advantage that it leaves the honour of the ancients untouched ·because I shall not be *arguing against* them. I shall be *opposing* them, but· there will be no disparagement of them in this, because the question at issue between them and me concerns only *the way*. As the saying goes: a lame man on the right road outstrips the runner who takes a wrong one. Indeed, it is obvious that a man on the wrong road goes further astray the faster he runs. ·You might think that in claiming to be able to do better in the sciences than they did, I must in some way be setting myself up as brighter than they are; but it is not so·. The course I propose for discovery in the sciences leaves little to the acuteness and strength of intelligence, but puts all intelligences nearly on a level. My plan is exactly like the drawing of a straight line or a perfect circle: to do it free-hand you need a hand that is steady and practised, but if you use a ruler or a compass you will need little if anything else; and my method is just like that.

·End of aside·

But though particular counter-arguments would be useless, I should say something about •the classification of the sects whose theories produce these idols, about •the external signs that there is something wrong with them, and lastly

•about the causes of this unhappy situation, this lasting and general agreement in error. My hope is that this will make the truth more accessible, and make the human intellect more willing to be cleansed and to dismiss its idols.

62. There are many idols of the theatre, or idols of theories, and there can be and perhaps will be many more. For a long time now two factors have militated against the formation of new theories ·in philosophy and science·.

- •Men's minds have been busied with religion and theology.
- •Civil governments, especially monarchies, have been hostile to anything new, even in theoretical matters; so that men have done that sort of work at their own peril and at great financial cost to themselves—not only unrewarded but exposed to contempt and envy.

If it weren't for those two factors, there would no doubt have arisen many other philosophical sects like those that once flourished in such variety among the Greeks. Just as many hypotheses can be constructed regarding the phenomena of the heavens, so also—and even more!—a variety of dogmas about the phenomena of philosophy may be set up and dug in. And something we already know about plays that poets put on the stage is also true of stories presented on the philosophical stage—namely that fictions invented for the stage are more compact and elegant and generally liked than true stories out of history!

What has gone wrong in philosophy is that it has attended in great detail to a few things, or skimpily to a great many things; either way, it is based on too narrow a foundation of experiment and natural history, and decides on the authority of too few cases. **(1)** Philosophers of the reasoning school snatch up from experience a variety of common kinds of event, without making sure they are getting them right and without carefully examining and weighing them; and then they let meditation and brain-work do all the rest. **(2)** Another class of philosophers have carefully and accurately studied a few experiments, and have then boldly drawn whole philosophies from *them*, making all other facts fit in by wildly contorting them. **(3)** Yet a third class consists of those who are led by their faith and veneration to mix their philosophy with theology and stuff handed down across the centuries. Some of these have been so foolish and empty-headed as to have wandered off looking for knowledge among spirits and ghosts. So there are the triplets born of error and false philosophy: philosophies that are **(1)** sophistical, **(2)** empirical, and **(3)** superstitious.

[To explain Bacon's second accusation against Aristotle in **63**: A word 'of the second intention' is a word that applies to items of thought or of language (whereas things that are out there in the world independently of us are referred to by words 'of the first intention'). Now Aristotle in his prime held that the soul is not *a substance* but rather *a form*: rather than being an independently existing thing that is somehow combined with the rest of what makes up the man, the soul is a set of facts about how the man acts, moves, responds, and so on. Bacon has little respect for the term 'form': in **15** he includes it among terms that are 'fantastical and ill-defined', and in **51** he says that 'forms are fabrications of the human mind'. This disrespect seems to underlie the second accusation; the class of *forms* is not a class of independently existing *things* but rather a class of muddy and unfounded *ways of thinking and talking*, so that 'form' is a word of the second intention.]

63. The most conspicuous example of **(1)** the first class was Aristotle, whose argumentative methods spoiled natural philosophy. He

- •made the world out of categories;
- •put the human soul, the noblest of substances, into a class based on words of the second intention;

- •handled the issues about density and rarity (which have to do with how much space a body takes up) in terms of the feeble distinction between what does happen and what could happen;
- •said that each individual body has one proper motion, and that if it moves in any other way this must be the result of an external cause,

and imposed countless other arbitrary restrictions on the nature of things. He was always less concerned about the inner truth of things than he was about providing answers to questions—*saying* something definite. This shows up best when his philosophy is compared with other systems that were famous among the Greeks. For

- •the homogeneous substances of Anaxagoras,
- •the atoms of Leucippus and Democritus,
- •the heaven and earth of Parmenides,
- •the strife and friendship of Empedocles, and
- •Heraclitus's doctrine of bodies' being reduced to the perfectly homogeneous condition of fire and then remolded into solids,

all have a touch of natural philosophy about them—a tang of the nature of things and experience and bodies. Whereas in Aristotle's physics you hear hardly anything but the sounds of logical argument—involving logical ideas that he reworked, in a realist rather than a nominalist manner, under the imposing name of 'metaphysics'. Don't be swayed by his frequent mentions of experiments in his *On Animals*, his *Problems*, and others of his treatises. For he didn't consult experience, as he should have done, *on the way to* his decisions and first principles; rather, he first *decided* what his position would be, and *then* brought in experience, twisting it to fit his views and making it captive. So on this count Aristotle is even more to blame than his modern followers, the scholastics, who have abandoned experience altogether.

64. The **(2)** empirical school of philosophy gives birth to dogmas that are more deformed and monstrous than those of the sophistical or reasoning school. The latter has as its basis the •light of vulgar notions; it's a faint and superficial light, but it is in a way •universal, and applies to many things. In contrast with that, the empirical school has its foundation in the •narrowness and •darkness of a few experiments. Those who busy themselves with these experiments, and have infected their imagination with them, find such a philosophy to be probable and all but certain; everyone else finds them flimsy and incredible. A notable example of this ·foolishness· is provided by the alchemists and their dogmas; these days there isn't much of it anywhere else, except perhaps in the philosophy of Gilbert. Still, I should offer a warning relating to philosophies of this kind. If my advice ever rouses men to take experiments seriously and to bid farewell to sophistical doctrines, then I'm afraid that they may—I foresee that they *will*—be in too much of a hurry, will leap or fly ·from experiments straight· to generalizations and principles of things, risking falling into just the kind of philosophy I have been talking about. We ought to prepare ourselves against this evil now, ·well in advance·.

65. The corruption of philosophy by **(3)** superstition and input from theology is far more widespread, and does the greatest harm, whether to entire systems or to parts of them. ·Systems thus afflicted are just nonsense judged by ordinary vulgar standards, but that doesn't protect men from accepting them, because· the human intellect is open to influence from the imagination as much as from vulgar notions, ·and in these philosophies it is the imagination that wields the power·. Whereas the contentious and sophistical kind of philosophy combatively *traps* the intellect, this ·superstitious· kind, being imaginative and high-flown and

half-poetic, *coaxes* it along. For men—especially intelligent and high-minded ones—have intellectual ambitions as well as ambition of the will.

A striking example of this sort of thing among the Greeks is provided by Pythagoras, though ·his form of it wasn't so dangerous, because· the superstition that he brought into it was coarser and more cumbrous ·than many·. Another example is provided by Plato and his school, whose superstition is subtler and more dangerous. Superstition turns up also in parts of other philosophies, when they

> introduce abstract forms—·i.e. forms that aren't the forms *of* anything·,

and when they do things like

> speaking of 'first causes' and 'final causes' and usually omitting *middle* causes.

[Bacon's point is: They discuss the first cause of the whole universe, and the end or purpose for which something happens (its 'final cause'), but they mostly ignore ordinary *causes* such as spark's causing a fire. Putting this in terms of first-middle-final seems to be a quiet joke]. We should be *extremely* cautious about this. There's nothing worse than the *deification* of error, and it is a downright plague of the intellect when empty nonsense is treated with veneration. Yet some of the moderns have been so tolerant of this emptiness that they have—what a shallow performance!—tried to base a system of natural philosophy on the first chapter of Genesis, on the book of Job, and other parts of the sacred writings, 'seeking the living among the dead' [Luke 24:5]. This makes it more important than ever to keep down this ·kind of philosophy·, because this unhealthy mixture of human and divine gives rise not only to •fantastic philosophy but also to •heretical religion. It is very proper that we soberly give our faith only to things that *are* the faith.

66. So much for the mischievous authority of systems founded on •vulgar notions, on •a few experiments, or on •superstition. I should say something about bad choices of what to think *about*, especially in natural philosophy. In the mechanical arts the main way in which bodies are altered is by composition or separation; the human intellect sees this and is infected by it, thinking that something like it produces all alteration in the universe. This gave rise to •the fiction of *elements* and of their coming together to form natural bodies. Another example: When a man surveys nature working freely, he encounters different species of things—of animals, of plants, of minerals—and that leads him smoothly on to the opinion that nature contains certain *primary forms* which nature intends to work with, and that all other variety comes from •nature's being blocked and side-tracked in her work, or from •conflicts between different species—conflicts in which one species turns into another. To the first of these theories we owe ·such intellectual rubbish as· *first qualities of the elements*; to the second we owe *occult properties* and *specific virtues*. Both of them are empty short-cuts, ways for the mind to come to rest and not be bothered with more solid pursuits. The medical researchers have achieved more through their work on the second qualities of matter, and the operations of attracting, repelling, thinning, thickening, expanding, contracting, scattering, ripening and the like; and they would have made much greater progress still if *it weren't for a disaster that occurred. The two short-cuts that I have mentioned (elementary qualities and specific virtues) snared the medical researchers, and spoiled what they did with their correct observations in their own field. [The passage flagged by asterisks expands what Bacon wrote, in ways that the small-dots system can't easily indicate.] It led them either •to treating second qualities as coming from highly complex and subtle mixture of first or elementary qualities, or •to breaking off

their empirical work prematurely, not following up their observations of second qualities with greater and more diligent observations of third and fourth qualities.* ·This is a bigger disaster than you might think, because· something like—I don't say *exactly* like—the powers involved in the self-healing of the human body should be looked for also in the changes of all other bodies.

But something much worse than that went wrong in their work: they focussed on

- •the principles governing things at rest, not on •the principles of change; i.e. on
- •what things are produced *from*, not •*how* they are produced; i.e. on
- •topics that they could talk about, not •ones that would lead to results.

The vulgar classification of ·kinds of· motion that we find in the accepted system of natural philosophy is no good—I mean the classification into

> generation,
> corruption,
> growth,
> diminution,
> alteration, and
> motion.

Here is what they mean. If a body is moved from one place to another without changing in any other way, this is •motion; if a body changes qualitatively while continuing to belong to the same species and not changing its place, this is •alteration; if a change occurs through which the mass and quantity of the body don't remain the same, this is •growth or •diminution; if a body is changed so much that it changes substantially and comes to belong to a different species, this is •generation or •corruption. But all this is merely layman's stuff, which doesn't go at all deeply into nature; for these are only *measures* of motion. . . .and not *kinds* of motion. They [= the notions involved in the classification into generation, corruption etc.] signify that the motion went this way or that, but not *how* it happened or what *caused* it. They tell us nothing about the appetites of bodies [= 'what bodies are naturally disposed to do'] or about what their parts are up to. They come into play only when the motion in question makes the thing grossly and obviously different from how it was. Even when ·scientists who rely on the above classificatory system· do want to indicate something concerning the *causes* of motion, and to classify motions on that basis, they *very* lazily bring in the ·Aristotelian· distinction between 'natural' motion and 'violent' motion, a distinction that comes entirely from vulgar ways of thinking. In fact, 'violent' motion is natural motion that is called 'violent' because it involves an external cause working (naturally!) in a different way from how it was working previously. [Bacon himself sometimes describes a movement as *violens*, but this is meant quite casually and not as a concept belonging to basic physics. These innocent occurrences of *violens* will be translated as 'forceful'.]

Let us set all this aside, and consider such observations as that bodies have an appetite for

> mutual contact, so that separations can't occur that would break up the unity of nature and allow a vacuum to be made;

or for

> resuming their natural dimensions. . . ., so that if they are compressed within or extended beyond those limits they immediately try to recover themselves and regain their previous size;

or for

> gathering together with masses of their own kind—e.g. dense bodies ·moving· towards the earth, and light and rare bodies towards the dome of the sky.

These and their like are truly *physical* kinds of motion; and comparison of them with the others that I mentioned makes clear that the others are entirely *logical* and *scholastic*.

An equally bad feature of their philosophies and their ways of thinking is that all their work goes into investigating and theorizing about the

- •·fundamental· principles of things. . . .—so they keep moving through higher and higher levels of abstraction until they come to *formless potential matter*—and
- •the ultimate parts of nature—so they keep cutting up nature more and more finely until they come to *atoms*, which are too small to contribute anything to human welfare—

whereas everything that is useful, everything that can be worked with, lies between ·those two extremes·.

67. The intellect should be warned against the intemperate way in which systems of philosophy deal with the giving or withholding of assent, because intemperance of this kind seems to establish idols and somehow prolong their life, leaving no way open to reach and dislodge them.

There are two kinds of excess: •the excess of those who are quick to come to conclusions, and make sciences dogmatic and lordly; and •the excess of those who deny that we can know anything, and so lead us into an endlessly *wandering* kind of research. The •former of these subdues the intellect, the •latter deprives it of energy. The philosophy of Aristotle ·is of the former kind·. Having destroyed all the other philosophies in argumentative battle. . . . Aristotle laid down the law about everything, and then proceeded to raise new questions of his own and to dispose of them likewise, so that everything would be certain and settled—a way of going about things that his followers still respect and practice.

The ·Old Academy·, the school of Plato, introduced acatalepsy—·the doctrine that nothing is capable of being understood·. At first it was meant as an ironical joke at the expense of the older sophists—Protagoras, Hippias, and the rest—whose greatest fear was to seem *not* to doubt something! But the New Academy made a dogma of acatalepsy, holding it as official doctrine. They did allow of some things to be followed as probable, though not to be accepted as true; and they said they didn't ·mean to· destroy all investigation; so their attitude was better than. . . .that of Pyrrho and his sceptics. (It was also better than undue freedom in making pronouncements.) Still, once the human mind has despaired of finding truth, it becomes less interested in everything; with the result that men are side-tracked into pleasant disputations and discourses, into *roaming*, rather than severely sticking to a single course of inquiry. But, as I said at the start and continue to urge, the human senses and intellect, weak as they are, should not be •deprived of their authority but •given help.

68. So much for the separate classes of idols and their trappings. We should solemnly and firmly resolve to deny and reject them all, cleansing our intellect by freeing it from them. Entering the kingdom of man, which is based on the sciences, is like entering the kingdom of heaven, which one can enter only as a little child.

69. But the idols have defences and strongholds, namely defective demonstrations; and the demonstrations we have in dialectics do little except make •the world a slave to •human thought, and make human thought a slave to •words. Demonstrations are indeed incipient philosophies and sciences: how good or bad a demonstration is determines how good or bad will be the system of philosophy and the thoughts that follow it. Now the demonstrations that we use in our whole process of getting from the •senses

and •things to •axioms and conclusions are defective and inappropriate. This process has four parts, with a fault in each of them. **(1)** The impressions of the senses itself are faulty, for the senses omit things and deceive us. Their omissions should be made up for, and their deceptions corrected. **(2)** Notion are abstracted *badly* from the impressions of the senses, and are vague and confused where they should be definite and clearly bounded.

(3) Induction goes wrong when it infers scientific principles by simple enumeration, and doesn't, as it should, take account of the exceptions and distinctions that nature is entitled to. **(4)** The method of discovery and proof in which you *first* state the most general principles and *then* bring the intermediate axioms into the story, 'proving' them from the general principles, is the mother of errors and a disaster for all the sciences. At this stage I merely touch on these matters. I'll discuss them more fully when, after performing these cleansings and purgings of the mind, I come to present the true way of interpreting nature.

70. The procedure that starts with experience and *sticks close to it* is the best demonstration by far. A procedure that involves transferring a result to other cases that are judged to be similar is defective unless the transfer is made by a sound and orderly process. The way men conduct experiments these days is blind and stupid. Wandering and rambling with no settled course and only such 'plans' as events force on them, they cast about and touch on many matters, but don't get far with them. Sometimes they are eager, sometimes distracted; and they always find that some further question arises. They usually conduct their experiments casually, as though this were just a game; they slightly vary experiments that are already known; and if an experiment doesn't come off, they grow weary and give up the attempt. And even if they worked harder at their experiments, applying themselves more seriously and steadfastly, ·they *still* wouldn't get far, because· they work away at some *one experiment*, as Gilbert did with the magnet and the chemists do with gold. That is a way of proceeding that is as unskilful as it is feeble. For no-one successfully investigates the nature of a thing taken on its own; the inquiry needs to be enlarged so as to become more general.

And even when they try to draw some science, some doctrines, from their experiments, they usually turn aside and rashly embark on premature questions of practical application; not only for the practical benefits of such applications, but also because they want to *do* things that will •assure them that it will be worth their while to go on, and •show themselves in a good light to the world and so •raise the credit of the project they are engaged in. They are behaving like Atalanta ·in the legend from ancient Greece·: she turned aside to chase a golden ball, interrupting her running of the race and letting victory slip through her fingers. But in using the true course of experience to carry out new works, we should model our behaviour on the divine wisdom and order. On the first day of creation God created light and nothing else, devoting an entire day to a work in which no material substance was created. We should follow suit: with experience of any kind, we should first try to discover true causes and axioms, looking for •enlightening experiments rather than for •practically fruitful ones. For axioms don't *singly* prepare the way for practical applications, but *clusters of* rightly discovered and established axioms do so, bringing in their wake streams—*crowds*!—of practical works. The paths of experience are just as rocky and jammed as the paths of judgment, and I'll discuss that later. I have mentioned ordinary experimental work at this stage only in its role as a bad kind of demonstration. But considerations of order

now demand that I take up next ·two linked topics·: •the signs or omens (mentioned a little way back) that current systems of philosophy and of thought are in a bad condition; and •the causes of ·this badness, which· seems at first so strange and incredible. When you have seen •the signs you will be more likely to agree ·with me about the badness·; and my explanation of •its causes will make it seem less strange. These two together will greatly help to render the process of wiping the idols from the intellect easier and smoother. ·My discussion of •the signs will run to the end of **77**, and •the causes will run from there to the middle of **92**·. [In the next seven sections, the Latin *signa* will be translated sometimes as 'signs' and sometimes as 'omens'.]

71. The sciences that we have come mostly from the Greeks. For the additions by Roman, Arabic and later writers are neither plentiful nor important, and such as they are they have been built on the foundation of Greek discoveries. Now, the wisdom of the Greeks was that of teachers of rhetoric, and it spawned disputations, which made it the worst kind of inquiry for finding the truth. Those who wanted to be thought of as philosophers contemptuously gave the label 'sophists' to the ancient rhetoricians Gorgias, Protagoras, Hippias and Polus; but really the label fits the whole lot of them: Plato, Aristotle, Zeno, Epicurus, Theophrastus, and their successors Chrysippus, Carneades and so on. There was this just difference: •the rhetoricians were wandering and mercenary, going from town to town, offering their wisdom for sale, and taking a price for it; whereas •the others were more ceremonial and 'proper'—men who had settled homes, and who opened schools and taught their philosophy without charging for it. But although the two groups of philosophers were in other ways unalike, they had one thing in common: both lots were teachers of rhetoric; both turned everything into a matter for disputations, and created sects that they defended against heresies. They turned it all into •'the talk of idle old men to ignorant youths' (Dionysius's jibe against Plato, a not unfair one!). But the earlier of the Greek philosophers—Empedocles, Anaxagoras, Leucippus, Democritus, Parmenides, Heraclitus, Xenophanes, Philolaus and so on (omitting Pythagoras because he was a mystic)—didn't open schools, as far as we know. What they did was to *apply themselves to the discovery of truth*, doing this

> •more quietly, severely and simply—that is, with less affectation and parade—

than the others did. And in my judgment they also performed

> •more successfully,

·or would have done so· if it weren't for the fact that their works were in the course of time obscured by less substantial people who offered more of what suits and pleases the capacity and tastes of the vulgar. Time is like a river, bringing lightweight floating stuff down to us and letting heavier and solider things sink. Still, not even they—·Empedocles and the rest·—were entirely free of the Greek fault: they leaned too far in the direction of ambition and vanity, founding sects and aiming for popular applause. The inquiry after •truth has no chance of succeeding when it veers off after •trifles of this kind. And I ought to mention the judgment, or rather the prediction, that an Egyptian priest made about the Greeks, namely that 'they are always *boys*, with no •long-established knowledge and no •knowledge of ancient times' [neater in Latin: •*antiquitatem scientiae* and •*scientiam antiquitatis*]. Assuredly they were like boys in their readiness to chatter, and in their inability to father anything—for their wisdom is full of words but sterile in works. So when we consider the currently accepted philosophy in the light of its place of origin and its family tree, the omens are not good!

72. And the omens provided by the character of the time and age aren't much better than the ones from the character of the place and the nation. For knowledge at that period concerned only a short stretch of time and a small part of the world, and that's the worst state to be in, especially for those who base everything on experience. For the preceding thousand years they had no *history* worthy of the name, but only fables and verbal traditions. And they knew only a small portion of the regions and districts of the world; they indiscriminately called everyone to the north of them 'Scythians'. and those to the west 'Celts'; they knew nothing of Africa beyond the nearest part of Ethiopia, or of Asia beyond the Ganges. They knew even less about the provinces of the New World. . . .and declared to be uninhabitable a multitude of climates and zones where actually countless nations live and breathe. . . . (Contrast that with the present day: we know many parts of the New World as well as the whole of the Old World, and our stock of experience has grown infinitely.) So if like astrologers we take omens ·for contemporary systems of philosophy· from the facts about *when* they were born, we can't predict anything great for them.

73. Of all the signs ·we can have of the value of a field of endeavour·, none are more certain or more conspicuous than those based on the *upshots* ·of the endeavour·. For upshots and useful practical applications are like sponsors and guarantors of the truth of philosophies. [Throughout this work, 'philosophies' include 'sciences'.] Now, from all those systems of the Greeks and the particular sciences derived from them, you can hardly name a single experiment that •points the way to some improvement in the condition of man, and that •really does come from the speculations and theories of philosophy. Hardly one, after all those years! And Celsus honestly and sensibly admits as much, when he tells us that •the practical part of medicine was discovered first, and that *then* •men philosophized about it and hunted for and assigned causes; rather than the reverse process in which •philosophy and the knowledge of causes led to •the discovery and development of the practical part. So it isn't strange that among the Egyptians, who rewarded inventors with divine honours and sacred rites, there were more images of the lower animals than of men; for the lower animals have made many discoveries through their natural instincts, whereas men have given birth to few or none through their discussions and rational inferences.

The work of chemists has produced a little, but only •accidentally and in passing or else •by varying previous experiments (just as a mechanic might do!), and not by any skill or any theory. For the theory that they have devised does more to confuse the experiments than to help them. And the people who have busied themselves with so-called 'natural magic' have come up with nothing but a few trifling and apparently faked results. In religion we are warned to *show our faith by our works*; the same rule applies in philosophy, where a system should be judged by its fruits, and pronounced frivolous if it turns out to be barren, especially when it bears the thorns and thistles of dispute and contention rather than the fruits of grape and olive.

74. The growth and progress of systems and sciences provides signs ·as to their value·. Something that is grounded in nature grows and increases, while what is based on opinion *alters* but doesn't *grow*. If those doctrines ·of the ancient Greeks· hadn't been so utterly like a plant torn up by its roots, and had remained attached to and nourished by the womb of nature, the state of affairs that we have seen to obtain for two thousand years—namely

> the sciences stayed in the place where they began, hardly changing, not getting any additions worth mentioning, thriving best in the hands of their first founders and declining from then on

—would never have come about. This is the opposite of what happens with the mechanical arts, which are based on nature and the light of experience: they (as long as they find favour with people) continually thrive and grow, having a special kind of *spirit* in them, so that they are at first rough and ready, then manageable, from then onwards made smoothly convenient by use—and *always growing*.

75. Admissions made by the very authorities whom men now follow constitute another sign ·that today's sciences are in trouble·—if it is all right to apply the label 'sign' to what is really testimony, indeed the most reliable of all testimony. Even those who so confidently pronounce on everything do intermittently pull themselves together and complain of the subtlety of nature, the obscurity of things, and the weakness of the human mind. ·These complaints are not just a sign of trouble in the sciences; they are worded in such a way that they cause further harm·. If these people merely *complained*, some cowards might be deterred from searching further, while others with livelier minds and a more hopeful spirit might be spurred and incited to go on. But the complainers don't merely speak for themselves: if something is beyond their knowledge or reach, and of their master's, they declare it to be beyond the bounds of possibility, something that can't be known or done; so that their lofty ill-nature turns the weakness of their own 'discoveries' into a libel against nature herself and a source of despair for the rest of the world. •Thus the school of the New Academy, which doomed men to everlasting darkness by maintaining as a matter of doctrine that nothing at all could be known. •Thus the opinion that men can't possibly discover the *forms*, i.e. the real differentiae of things ·that put things into different species· (really they are laws of pure action [see note on page 12]). •Thus also certain opinions in the field of action and operation, e.g. that the heat of the sun is quite different in kind from the heat of fire, so that no-one will think that the operations of fire could produce anything like the works of nature ·that are produced by the sun·. •That's the source of the view that. . .

Latin: . . . *compositionem tantum opus hominis, mistionem vero opus solius naturae esse*
literal meaning: . . . men are capable only of composition, and mixing has to be the work of nature
intended meaning? . . . men are capable only of assembling things into physical mixtures (e.g. salt and pepper), and the subtler kind of combination involved in something's being gold or water or salt or the like must be the work of nature

—lest men should hope to develop techniques for generating or transforming natural bodies, ·e.g. creating water or turning lead into gold·. ·I point out· this sign ·of second-rateness· to warn you not to let your work and your career get mixed up with dogmas that are not merely discouraging but are *dedicated* to discouragement.

76. Here is another sign ·of something's being wrong· that I oughtn't to pass over: the fact that formerly there existed among philosophers such great disagreement, and such differences between one school and another. This shows well enough that the road from the senses to the intellect was not well defended ·with walls along each side·, when the same raw material for philosophy (namely the nature of things) has been taken over and used to construct so many wandering pathways of error. These days, most of the

disagreements and differences of opinion on first principles and entire ·philosophical· systems have been extinguished; but there are still endless questions and disputes concerning some *parts* of philosophy, which makes it clear that there is nothing certain or sound in the systems themselves or in the modes of demonstration ·that they employ·.

77. Some men think this:

> There ·*is* great agreement in philosophy these days, because there is· widespread agreement in assenting to the philosophy of Aristotle; as witness the fact that once it was published the systems of earlier philosophers fell into disuse and withered away, while in the times that followed nothing better was found. Thus, it seems to have been so well laid out and established that it has drawn both ages—·ancient and modern·—to itself.

I start my reply to this by remarking that the general opinion that the old systems stopped being used or consulted when Aristotle's works were published is *false*. In fact, long afterwards—even down to the times of Cicero and later centuries—the works of the old philosophers still remained. But in the times that followed, when the flood of barbarians pouring into the Roman empire made a shipwreck of human learning, *then* the systems of Aristotle and Plato, like planks of lighter and less solid material, floated on the waves of time and were preserved. As for the point about agreed assent: if you look into this more carefully you'll see that the view I am discussing is wrong about that too. For genuine *agreement* is based on people's having duly examined some matter and reached, freely ·and independently·, the same opinion about it. But the great majority of those who have assented to the philosophy of Aristotle have delivered themselves over to it on the strength of the prejudices and the authority of others; so that this is less a case of *agreement* than of *moving together as a crowd*. But even if it had been a real and widespread agreement, that is so far from being •solid confirmation of the truth ·of Aristotle's philosophy· that it actually creates a •strong presumption of its falsity. For in intellectual matters the *worst* of all auguries is ·general· consent, except in theology (and in politics, where there is a right to vote!). This is because of something I have already mentioned: that nothing pleases the multitude unless it appeals to the imagination or ties the intellect up with knots made from the notions of the vulgar. Something that Phocion said about morals can very well be re-applied to intellectual matters, namely that if the multitude accept ·what you say· and are united in their applause, you should immediately check yourself to see where you have gone wrong. So *this* sign is one of the *least* favourable.

That brings me to the end of what I have to say to make my point that the signs of health and truth in the currently accepted philosophical systems and sciences are *not good*, whether they be drawn from their origins (**71–2**), their upshots (**73**), their progress (**74**), the admissions of their founders (**75**), or agreed acceptance (**77**).