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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APHORISMS CONCERNING THE INTERPRETATION OF NATURE: BOOK 2: 26–43

26. Class 5 of privileged instances: **constitutive instances**, which I also like to call 'bundled' instances. They are ones that constitute a single *species* of the nature we are investigating; they are a sort of minor form, ·not the major form of the nature as a whole·. Genuine ·non-lesser· forms are always convertible with the natures we are studying:

·where you have F you have N, and vice versa, ·

whereas with a lesser form LF,

where you have LF you have N, but *not* vice versa.

Genuine forms lie deep and are hard to find; so the nature of the case and the weakness of our intellects dictate that we shouldn't neglect—indeed that we should carefully attend to—particular forms that bundle up certain groups of instances (though not all) into some common notion. For anything that pulls a nature together, even partially, opens the way to the discovery of forms. So instances that are useful in this way are not negligible—they have a certain privilege.

But we must be very careful here to avoid a certain great danger. It is that our minds, having discovered many of these particular forms and on the basis of them established partitions or divisions of the nature we are investigating, will settle for *that* and assume that the nature in question is multiple and divided the whole way down, scoffing at any ·attempt at· further unification of the nature and rejecting it as pointless subtlety and verging on mere abstraction. This would stop us from preparing to make the legitimate discovery of the major form. [The next long paragraph starts 'For example'. What it offers are six examples of constitutive instances, not examples of the need for the warning Bacon has just given. The warning, as applied to these six, would say: 'Don't think that these six "minor forms" of aid-to-memory are the whole story, and that there is no "major form", no unitary process of aiding-memory of which these six are only special cases.' Bacon presumably believed this, but you'll see that he doesn't say it or anything like it in this next paragraph.]

Suppose for example that the nature we are investigating is *memory*, or *triggers and helps for the memory*. **1** A constitutive ·or bundled· instance of this ·has three components·: **(a)** *Order* or *arrangement*, which clearly aids the memory. ·An example might be: being helped to remember what we did on a certain date by remembering that first we did A, then we did B, and so on *in order* through our day·. **(b)** 'Places' in artificial memory [= 'memory helped by artifice']. These may be either (a) places in the literal sense of the word—a door, a corner, a window or the like—or (b) 'places' in some ordered list of familiar and well-known persons, animals, plants, words, letters, or whatever; though some of these work better than others. Such •artificial 'places' help the memory wonderfully, and raise it far above its •natural powers. **(c)** Verse is learned and remembered more easily than prose. This bundled trio of instances—order, artificial 'places', and verse—constitutes one species of aid to the memory, a species that could rightly be called *limiting the unlimited*. When you try to recall something without having in advance any notion of what you are looking for, you are looking and working and rushing about in a seemingly unlimited space. But if you have a definite notion of it in advance, that immediately sets some limits, leaving your memory with much less space to rummage through. And in ·each of· the three instances I have described, the notion-in-advance is clear and definite. In the first, the item sought for must

be something that fits with the order;

in the second it must be

an image that has some relation or conformity to those specified 'places';

and in the third, it must be

words that fall into verse.

In each case, the unlimited is curtailed. **2** Other instances yield a second species—the one that most artificial aids to memory rely on. It is that anything that puts an intellectual conception in touch with the senses assists the memory. **3** Other instances provide this species: memory is helped by anything that makes an impression on our feelings—by inspiring fear, admiration, shame or delight. **4** From other instances we get: things are more likely to stick in the memory if they were chiefly imprinted when one's mind was clear, and hadn't just emerged from a cluttered state and wasn't about to go into such a state; that's why one is less likely to remember things learned in childhood, things thought of before going to sleep, things experienced for the first time. **5** Other instances will give us this species: memory is aided by there being a large variety of details ·in the material to be searched·—a variety of 'handles' for the memory to latch onto, such as breaking up a text into sections or reading or reciting aloud. **6** Lastly, other instances yield this species: things that are waited for and that attract one's attention will stay in the memory for longer than will things that just slip by. For example, you won't learn a passage as well by •reading it ·straight through· twenty times as you will by •reading it only ten times and trying each time to recite it from memory and looking at the text only when your memory fails. So there seem to be six minor forms of aid-to-memory, namely:

- •limiting the unlimited,
- •associating concepts with things that are sensorily perceptible,
- •impression made on the mind in a state of strong feeling,
- •impression made on a clear mind,
- •a large variety of points to take hold of,
- •expectation beforehand.

[Bacon next presents another example of a constitutive instance—one that is relevant to an inquiry into the nature of the sense of *taste*. It concludes: 'The sense of taste is a sort of compound of an internal *smell* and a delicate power of *touch*—but this is not the place to go into that.' Then:]

For another example, suppose the nature we are investigating is *passing on* [Latin *communicatio*] *a quality without passing on any substance*. The instance of light will give or constitute one species of passing-on, heat and the magnet another. ·They are different species, because· the passing on of light is virtually instantaneous, and stops the instant the original ·source of· light is removed. But when heat or magnetic power is transmitted to a body—or, rather, aroused in a body—it stays there for a considerable time after its source is removed.

Summing up: constitutive instances are *very* privileged, because they contribute greatly to making definitions (especially particular definitions) and to ·establishing· divisions or partitions of natures. Plato said a good thing about these two tasks: 'He who knows well how to define and to divide should be regarded as a god.'

27. Class 6 of privileged instances: **matching instances** or instances of **analogy**, which I also ·though not again in this work· call 'parallells' and 'physical resemblances'. They are the ones that bring out resemblances and linkages between

things—not between •minor forms (as constitutive instances do) but between •the things themselves. They are like the first, the lowest, steps toward the unity of a nature. They don't yield any axiom immediately from the beginning, but simply point out and mark a certain agreement between bodies. [On 'agreement', see note on page 88.] They aren't much use for the discovery of forms, but they are very useful in revealing the structure of the parts of a whole, and taking apart its members; and from this they often lead us by the hand, as it were, to sublime and noble axioms, especially to ones concerning •the structure of the world rather than •simple forms and natures.

These are instances of matching:

•an eye and •a mirror,

•the construction of the ear and •places that return an echo.

From these matches. . . .it is easy to gather and form this axiom:

> The •organs of the senses are similar in nature to •bodies that produce reflections to the senses.

On this hint the understanding easily rises to this higher and nobler axiom:

> •Bodies endowed with sense agree and harmonize ·with things in their environment·, and so do •inanimate bodies without sense. The only difference is that in the former but not the latter an *animal spirit* is added to a body that is fit to make use of it.

It follows from this that animals would have ·many more senses than they do·—even as many •senses as inanimate bodies have •ways of responding to their environments—if an animal body had ·more· perforations allowing the animal spirit to pass freely into an appropriately structured part of the body, as into a healthy sense-organ. Inanimate bodies with no animal spirit have as many •ways of moving as animals have •senses—indeed many *more*; because how many senses an animal has is limited by its small number of sense-organs. A vivid example of this concerns *pain*. There are many kinds and varieties of pain in animals (the pain of burning, of intense cold, of pricking, squeezing, stretching and the like), but all of these, considered as kinds of motion, also occur in inanimate substances. Think of what happens in wood or stone that is burned or frozen or drilled or cut or bent or stretched, and so on, though the senses don't come into this because of the lack of animal spirit ·and of sense-organs acted on by animal spirit·.

•The roots of plants and •their branches are matching instances, for every plant swells and pushes out its parts into the environment, •downward as well as •upward. It may seem odd to call this a case of *matching*, ·but it really is one, because· the only difference between roots and branches is that the root is buried in the ground while the branches are exposed to the air and sun. For if you take a tender, living •branch of a tree and bend it down and stick it into the earth, it won't itself interact with the ground but it will soon put out not a branch but a •root. . . .

•Tree resins and most •rock gems are instances of matching. Both of these are simply juices that have been filtered ·and hardened· after being extruded in one case from trees and in the other from rocks. What makes each of them so clear and beautiful is the fine and delicate filtering they have been through. ·Another example of the aesthetic power of filtering·: the reason why animal fur is not as lovely and brightly coloured as the plumage of many birds is that juices don't filter so finely through skin as through quills.

Another instance of matching: •the scrotum in males and the •womb in females. In land animals the physical difference between the sexes seems come down to the difference between •external and •internal. The greater force of heat in

the male forces the genitals outward, while in the female the heat is too weak to do this, so her genitals stay inside.

The ·four· •fins of fish and the •feet of quadrupeds and •the feet and wings of birds, are instances of matching; and Aristotle has added ·a further matching quartet, namely· the •four undulations in the motions of serpents. From this it seems that. . . .the motions of living creatures are generally brought about by a quartet of limbs or of bends.

The •teeth of land animals and the •beaks of birds are instances of matching; from which it is obvious that in all completed animals some hard substance moves towards the mouth.

And there is a similarity—don't dismiss this as absurd!—between a man and an upside-down plant. In ·a man and indeed in· animals generally, the root of the nerves and faculties is the head, while the part with seeds is at the bottom (I'm setting aside the legs and arms). In a plant, the root (which matches the animal head) is regularly located at the bottom while the seeds are at the top; ·so if you turn the plant upside down you get a *match*·.

A final point: I couldn't over-emphasize the need for men to change their focus when they are investigating and collecting natural history. Until now they have worked hard on observing the variety of things, and setting out in detail the **differences** that mark off the various species of animals, plants, and fossils—though most of these differences are •nature playing around rather than •differences that have serious significance for the sciences. Such things are fun to know about, and sometimes they are practically useful; but for getting insight into nature they are nearly or wholly useless. What we should be doing is to investigate and observe the **resemblances** and analogies of things, taken as wholes and also in their parts. These ·resemblances· are what unify nature, and get us started on achieving sciences.

[Then a paragraph warning against frivolous, fanciful, fictional 'resemblances', in favour of 'real and substantial resemblances' that are 'grounded in nature'. Then:]

Don't ignore the *matches* provided by large-scale aspects of how our world is configured. Take, for example, •Africa and •the region of Peru with the coastline stretching to the Straits of Magellan; these two regions have similar isthmuses and similar promontories, and that won't have come about by accident.

And ·the *match* between· the •old world and the •new world, both of which are very wide towards the north and narrow and pointed towards the south.

A remarkable matching instance is provided by •the intense cold existing in the so-called 'middle region' of the air and •the fierce fires that are often seen to burst out from beneath the ground. These two things ·have in common that they· are ultimates and extremes: the extreme of the nature of •cold toward the edge of the sky, and of the nature of •heat toward the bowels of the earth; ·each of these· coming about through. . . .a nature's rejection of the contrary nature.

A final point: don't neglect the matches that there are amongst the axioms of the sciences. [He cites a rhetorical device and a matching musical one; and an axiom of arithmetic and a matching rule about syllogisms. Then:] In short, it will be *very* useful in *many* cases if as many people as possible put their minds to work hunting down physical matches and similarities.

28. Class 7 of privileged instances: **unique instances**, which I also call 'irregular' instances. . . . These consist in bodies that seem to be out of line, almost cut off from the order of nature, having very little in common with other things of the same kind. Where matching instances are like *one another*, unique instances are only like *themselves*. Unique

instances are useful in the way that concealed instances are [see the start of **25** at page 74]. They are useful because they lead us to •pull out ·for separate inspection· the nature ·that makes the thing unique· and to •relate it to other natures, the aim being to discover •genera, common natures, that can then be divided up on the basis of genuine •specific differences. We shouldn't stop investigating until the properties and qualities we find in things that might be seen as *natural wonders* have been analysed and brought under some •form, some •definite law. In that way, every irregularity or singularity can be found to depend on some common form, and the only 'natural *wonder*' won't be in the species itself but in

Latin: *differentiis accuratis et gradu et concursu raro*
literal meaning: the exact differences and degrees and the unusual combination
actually meaning: ??

whereas *now* the thoughts of men don't get beyond calling such things 'secrets' and 'monstrosities' of nature, as though they had no causes and were exceptions to general rules.

Examples of unique instances are

the sun and moon—among stars
the magnet—among stones
mercury—among metals
the elephant—among quadrupeds
sexual sensations—among kinds of touch
scents that hunting dogs pick up—among kinds of smell.

Also, grammarians regard the letter S as unique because of how easily it combines with ·other· consonants, sometimes with two or even three, which no other letter does. Unique instances should be prized because they sharpen and quicken investigation and refresh intellects that have been made stale by habit and the common course of things.

29. Class 8 of privileged instances: **deviant instances**, that is, errors of nature, random and freakish things or events, in which nature turns aside and goes off her usual course. •Errors of nature differ from •unique instances in this: the latter are prodigies of •species, the former of •individuals. But they are alike in what they are useful for, namely •as a corrective for the effects on the intellect of the ordinary run of events, and •to reveal common forms. For we must approach deviant instances in the same way as unique instances: we must keep working at them until we discover the cause of the deviation. . . . If you know nature's ·regular· ways you'll more easily observe the deviations; and conversely if you know the deviations you'll more accurately describe nature's ·regular· ways.

Deviant instances differ from singular instances in being much more usable in practical and experimental work. It would be very hard to •produce a new species, but much easier to •vary a known species and from that to produce many rare and unusual results. It is easy to move from natural wonders to artificial wonders; for once we have detected a natural deviation and found out why it occurred, it won't be hard to create as many deviations from that nature as we wish, leading it •by artificial means to the point ·of deviation· which it had reached •by accident. And not only to that one point, but also to others, for errors in one area point the way to errors and deflections elsewhere. I needn't give examples of deviant instances, because there are so many of them. We should make a collection or particular natural history of all the weird and wonderful things to which nature gives birth—of every natural item that is new or rare or out of the ordinary. Our standards ·for admission into our catalogue of natural wonders· must be of the very highest, so that our results will be believed. We should be especially sceptical about wonders that depend in any way on religion, like the

ones that Livy recounts, and also about ones that we find in writers on natural magic or alchemy and other fable-loving men of that sort. We should accept ·into our natural history· only things drawn from serious and credible history and trustworthy reports.

30. Class 9 of privileged instances: **borderline instances**, which I also ·though not again in this work· call 'instances of sharing'. They exhibit species of bodies that seem to be made up out of two species, or elements that lie between one species and another. These instances could properly be classified as *unique* instances, since in the whole scheme of things they are rare and out of the ordinary. But they are important enough to deserve a class of their own, for

- they are excellent indicators of the composition and structure of things,
- they suggest causes for *how many* and *what* ordinary species the world contains, and
- they lead the intellect from what *is* to what *can be*.

Examples of these ·borderline instances· are:

- moss, which is between putrescence and a plant,
- some comets, between stars and blazing meteors,
- flying fish, between birds and fish,
- bats, between birds and quadrupeds,
- the ape, ·between man and beast·

—the ape of which Ennius wrote 'the ape, repulsive creature, how like us!'. Also mongrel animals that mix two different species, and the like.

31. Class 10 of privileged instances: **instances of** ·human· **power**. . . .which I also call 'instances of man's ingenuity' or 'of his physical skill'. These are the noblest, most perfect—as it were the *ultimate*—products of each ·human· art. [As noted on page 1, 'art' in this work refers to any human activity that involves techniques and requires skills. In the present section Bacon is evidently thinking mainly of practical 'arts' such as engineering, weaving, glass-blowing etc., though his mention of 'liberal arts' may be a gesture towards painting, music, poetry etc.] Our main object ·in science· is to make nature serve *our* needs and wants; and it's suitable to that end that we should list the works that are already in man's power (like listing the provinces that have already been subdued and occupied ·before embarking on new conquests·), especially the clearest and most perfect of them; because they are a good starting-point for the journey. . .

Bacon wrote: *. . . ad nova et hactenus non inventa.*

It could mean: . . . towards new things (·techniques or devices·) that haven't yet been invented.

Or it could mean: . . . towards new things (·scientific results·) that haven't yet been discovered.

For if you think hard about these ·most perfect works·, and push on from them with energetic zeal, it surely won't be long before you •develop and extend them or •deflect them to something new in their neighbourhood or •apply them to an even nobler use.

But that's not all. Rare and extraordinary works of •nature stimulate the intellect to investigate and discover *forms* capacious enough to include them, and—·this being my present point·—excellent and wonderful works of •art do the same thing. Indeed they do it even more ·than natural wonders do·, because with an •artificial wonder it is usually pretty clear how it was discovered and how it works, whereas for •natural wonders this is usually quite obscure.

But we must be *very* careful not to let wonderful works of art hold the mind down, tether it to the ground, so to speak. The danger is this:

> There's a risk that these works of art—which seem to be the high points of human activity—will capture and bewitch the intellect so that it can't make any

> further progress, because it will think that nothing of this sort can be done except in the way that *those* were done—perhaps improved by a little more work and more careful preparation.

The truth of the matter is quite different! It is quite certain •that the ways and means so far discovered for constructing things and carrying out processes are mostly very poor affairs, and •that all major power depends on—flows from the springs of—forms, and so far *no forms have been discovered*.

I gave examples of this earlier [1 **109**]; someone who gave his life to thinking hard about the war engines and battering-rams of the ancients wouldn't light on the discovery of cannon acting by means of gunpowder. And if he studied and thought about the manufacture of wool and cotton, he would never be led to discover the nature of the silkworm or silk.

All the most outstanding discoveries—think about it!—have been brought to light not by •small elaborations and developments of ·already-established· arts, but entirely by •chance. Now, chance takes *ages* to achieve anything; but the only way of moving faster than that is through the discovery of forms.

I needn't give examples of instances of power—there are so many of them. What *does* need to be done is this: seek out and thoroughly inspect all the mechanical arts, and all the liberal arts too (so far as they deal with works), and on that basis make a collection—a detailed history—of each art's most accomplished and perfect works, including their modes of production or operation.

But I don't restrict this project to works that set us wondering, the acknowledged masterpieces and mysteries of an art. ·Those are *not* what we should be mainly concerned with·, because ·our wonder at something is not a good indicator of its being scientifically significant·. Wonder is the child of rarity! Rare things make us wonder even if they are of quite ordinary kinds. Whereas things that really *do* call for wonder because of how they differ in kind from other species, if they are in common use in our environment, are hardly noticed.

Unique products of •arts should be attended to, just as should the unique products of •nature, which I have already discussed, ·and let us remember not to confuse 'unique' with 'unfamiliar'·. Although the sun, the moon, the magnet and so on are extremely familiar things, I count them as unique instances of nature; and we should have the same attitude to unique instances of the arts.

For example, one unique instance of art is *paper*, which is a very ordinary ·and familiar· thing. But, now, think about how most artificial materials are made. Some are textiles, woven from threads—silk, wool, linen or the like—at right angles. Others are made of dried liquids—brick, earthenware, glass, enamel, porcelain, and so on. When these are well compacted, they shine; otherwise they are hard but not shiny; and they are all brittle—they don't hold together ·when dropped onto a hard surface, for instance·. In contrast with all this, *paper* does hold together; you can cut or tear it (·which you can't do with glass etc,·); so that it imitates and almost rivals the skin or membrane of an animal, the leaf of a plant, and other such products of nature. It isn't brittle as glass is, or woven from threads as textiles are. Just like natural materials, it has *fibres* but not distinct *threads*. You'll have trouble finding any other artificial material like paper—it is in fact altogether unique. The best artificial things are •the ones that imitate nature most closely and •·the ones that don't imitate nature *at all*·—the ones that stand up to nature and turn it on its head.

Don't treat juggling and conjuring tricks as negligible instances of man's ingenuity or of his physical skill. The uses to which they are put are trivial and frivolous, but there may

be something to be learned from them.

Lastly, we shouldn't leave out superstition and magic (in the ordinary sense of that word). Such things lie buried deep beneath a mass of lies and fables, but they should be looked into a little to see whether some hidden natural operation is at work in them—as in spells,

Latin: *fortificatione imaginationis,*

literal meaning: strengthening of the imagination,

actual meaning: ?

agreement between things at a distance, transmission of impressions from mind to mind as well as from body to body, and the like.

32. Classes 1 through 5 of privileged instances shouldn't be collected •until a relevant nature is being investigated, and the same holds true for most of classes 11 through 27, which are still to come. But what I have said makes it obvious that the collecting of instances in classes 6 through 10—namely

> matching instances
> unique instances
> deviant instances
> borderline instances
> instances of ·human· power

—should be begun •right away, as a sort of particular history. Instances of those kinds can ·help to· organize the materials that the intellect takes in, correcting the poor job that is made of this by the intellect itself, which is absolutely bound to be affected, infected, and eventually perverted and distorted by the constant assaults of everyday impressions.

So these instances should be used as a preliminary to correcting and cleansing the intellect. ·They *can* do this· because anything that draws the intellect away from the things it is used to smoothes and levels its surface for the reception of the clear dry light of true ideas.

Such instances also clear and pave the road leading to practical applications, as I'll say in the proper place, when I come to deal with the move ·from the theoretical· to the practical. [He doesn't reach this in the present work.]

33. Class 11 of privileged instances: **instances of friendship** and of **enmity**, which I also call 'instances of fixed propositions'. ·Let N be the nature we are inquiring into. Then· instances in class 11 are the ones that exhibit a body or concrete substance which *always* brings N with it (as though N were a friend) or *never* does so (as though N were an enemy). [Bacon says this more colourfully, but the content is the same.] From instances of this kind we form sure universal propositions, either affirmative (·friend·) or negative (·enemy·), in which the subject is a concrete body and the predicate is the nature N. Particular propositions are wholly *un*fixed. I mean propositions in which the nature in question is found to be fleeting and movable with respect to any concrete body—sometimes •had or acquired by the body and sometimes •lacked or lost by it. That is why particular propositions have no special privilege—except in the case of *shifting* which I have already discussed [in **23** on page 72]. Still, even these particular propositions are useful when considered alongside universal propositions, as I shall show in the proper place. [He seems not to do so in this work.] For a proposition to count as 'universal' I don't require that it make a flawless and absolute affirmation or negation. There may be exceptions to it, but they must be rare and unique.

What instances of friendship are useful for is *narrowing down* the search for the form we are investigating. An instance of shifting tells us that the form of the nature we are investigating must be

> something that the *shifting* event either passes along or wipes out;

this ·lays a constraint on the nature in question, and in that sense· narrows down the search for it. Well, in a similar way, an instance of friendship (or of enmity) tells us that the form of the nature we are investigating must be

> something that enters as an ingredient into the make-up of that concrete body (or that refuses to enter it).

Thus, someone who knows what the constitution or microstructure is of such a body is well on the way to discovering the form of the nature in question.

Suppose for example that we are inquiring into the nature of *heat*. An instance of friendship is flame. For in water, air, stone, metal and most other substances heat is variable—it comes and goes—whereas *all* flame is hot, so that heat is *always* there when things come together to compose flame. But no instance of enmity towards heat is found in our world. We have no sensory evidence about the bowels of the earth, but of all the bodies that we *do* know there is not a single one that isn't susceptible of heat.

Or suppose we are inquiring into the nature of *solidity*. An instance of enmity towards solidity is *air*. Metal can be liquid or solid, so can glass; and water can be solid, namely when it is frozen; but it is impossible that air should ever lose its flowingness and become solid.

Regarding such instances of fixed propositions two cautions should be given—they bear on our present concern. **(1)** Where ·for a given nature· there is *no* universal affirmative or negative, that fact should be carefully noted as a definite negative result. That's what I did in the case of heat, for which nature offers no universal negatives so far as we can tell from our experience. Similarly, if we were investigating the nature of eternalness or incorruptibility—·i.e. investigating what would make something resistant to *ever* going wrong or falling apart·—there are no universal affirmatives to be found in our experience. For eternalness or incorruptibility can't be predicated of any of the bodies lying on the surface of the earth; ·and that—returning now to my warning—is a definite fact that we would have to take note of in such an inquiry·. **(2)** As well as universal propositions, affirmative or negative, concerning any concrete body, we should take note of concrete substances that come nearest to being negative ·or positive· instances of the nature we are inquiring into. If the nature is heat, the gentlest and least burning flames (·which are hot, but barely hot·); if it is incorruptibility, gold (·which isn't outright incorruptible, but comes close·). Such instances point to the line nature draws between being and non-being, ·e.g. between being and not being hot, or between being and not being corruptible·. They help to lay down the limits of the forms, preventing them from slithering and wandering beyond the conditions of matter.

34. Class 12 of privileged instances: **terminal instances**. . . . These ·instances of *extremes*· are instructive not only when attached to fixed propositions but also by themselves and in their own nature. For they clearly indicate

- •nature's real divisions,
- •the real measures of things,
- •how far a given nature can act or be acted on, and
- •the shift from one nature into another.

Examples: gold (·a terminal instance of· weight), iron (hardness), the whale (animal size), the dog (sense of smell), gunpowder explosion (speed of expansion), etc. And we should take note of extremes at the bottom of the scale as well as at the top—e.g. alcohol (·a terminal instance of· weight), silk (softness), skin-grubs (animal size) etc.

35. Class 13 of privileged instances: **instances of alliance or union**. These are the ones that mix and unite natures that are ·generally· thought to be heterogeneous and are marked

and set down as such in the accepted classifications.

Instances of alliance show that operations and effects attributed to some one nature as special to *it* may belong also to other ·supposedly· different natures, and that this supposed difference isn't genuine—it doesn't get down to the essences of the things, but consists only in different special cases of a common nature. So they are extremely useful in raising the intellect from •·specific· differences to •genera, and in getting rid of phantoms and false images of things that come before us, *masked*, in concrete substances.

Suppose for example that we are investigating the nature of heat. We are offered, as something very official and authentic, a three-part classification of kinds of heat:

> the heat of heavenly bodies,
> the heat of animals, and
> the heat of fire.

And we are told that these heats are distinct and heterogeneous in their actual essence and species—that is to say, in their specific nature. This is held to be especially true of the heat of fire as against the other two, because the heat of heavenly bodies and of animals •creates and nourishes, while the heat of fire •spoils and destroys. Well, then, here is a quite ordinary experience that provides an instance of alliance ·between the heat of heavenly bodies and the heat of fire·:

> A vine-branch is brought into a house where a fire is constantly kept burning, and the grapes on it ripen a whole month sooner than they would have out of doors. Thus, the ripening of fruit that is still on the tree, which would seem to be work for the sun, can be done by fire.

This makes it easy for the intellect to *rise*, •rejecting the notion of essential heterogeneity, •accepting that the heat of the sun shares a common nature with the heat of fire, and •investigating the real differences between them that cause them to work so differently ·in so many cases·.

There will turn out to be four of these differences. **(1)** The heat of the sun is far gentler and softer than the heat of fire. **(2)** The heat of the sun, especially as it reaches us through the air, is much more humid than the heat of fire. **(3)** The main difference: the heat of the sun is exceedingly inconstant, now approaching and increasing, now receding and diminishing. That's what contributes to the generation of bodies. For Aristotle was right when he said that the principal cause of births and deaths on the surface of our planet is the oblique course of the sun through the zodiac, which produces enormous variations—day and night, summer and winter—in how much heat the sun gives. But the man went straight on to twist and distort his good discovery. Laying down the law to nature in his typical manner, he dogmatically says that births are caused by the sun's coming closer, and deaths by its retreating; whereas really *each* plays a role in births *and* deaths, both of which are partly caused by *inconstancy* in the heat from the sun. . . . **(4)** Another very important difference between the heat of the sun and the heat of fire: the sun operates by gentle action through long periods of time, whereas fire, egged on by man's impatience, does its work much more quickly. [He goes on to say that a carefully managed *slow* and *irregular* fire would be enough like the sun in its effects to cure us of the notion that fires and heavenly bodies produce radically different kinds of heat. And he offers further instances of alliance in which fires do the work of the sun in reviving half-frozen butterflies, hatching eggs, and curing apoplexy. Then:] [In the next paragraph, 'rotate' doesn't cover a thing's rotating on its axis; the topic is moving around a closed loop, not necessarily a circular one.]

Or suppose we are investigating the nature of motion and rest. There seems to be wide acceptance of the three-part

division according to which bodies

rotate,
move in a straight line, or
don't move.

This is supposed to have deep philosophical roots, because a body must either

move without a terminus,
move towards a terminus, or
stay still at a terminus,

·the idea being that those three exhaust the possibilities·. It seems that the heavenly bodies are the ones that perpetually •rotate; that the globe of the earth is •stationary, and that other bodies move •straight up or •straight down, depending on whether they are light or heavy. The theory is that so-called 'light' or 'heavy' bodies are ones that are displaced from the region where they naturally belong, and that their up or down movements take them ·towards their proper regions, i.e.· towards masses or accumulations of bodies that are *like* them—light bodies upward towards the circuit of heaven, heavy ones downward towards the earth.

That's all very fine, but we have an instance of alliance in one of the lower comets that is far below the heaven and yet rotates. (Aristotle's fiction of a comet being tied to or following some one star has long been exploded, not only because it is such an unlikely theory but also because we *see* that the comets wander irregularly through various parts of the sky.)

Another instance of alliance on this subject is the motion of air. In the tropical regions, where the circles of rotation are larger, the air seems to *revolve* from east to west.

[He goes on to say that a full understanding of tides might reveal that 'rotatory motion is not limited to heavenly bodies, but is shared also by air *and water*'. Then:]

Even the upward movement of light objects is subject to variations ·that aren't recognized in the official three-part story·. A bubble of water can serve here as an instance of alliance. Air under water rises quickly to the surface; it isn't raised by any •effort or struggle of its own, but by being •*pushed* upwards. . . .by the descending water. When the air reaches the surface of the water ·it forms a bubble, that is· it is stopped from rising higher, by the water's slight resistance to parting from it; so its own tendency to rise must be very slight.

Or suppose we are investigating the nature of weight. The accepted view is that

•dense and solid bodies move toward the centre of the earth, while
•rare and light bodies move toward the circuit of the sky,

and that in each case the body in question is moving towards *its proper place*. Now, despite what they teach in the universities, it is just silly and childish to suppose that *place* can *do* anything. Some philosophers have said that if a hole were bored right through the earth, heavy bodies would fall to its centre and then stop. This ·implies that mere place—the centre of the earth—has some causal power; and it· is just babble. The only things that can act on bodies are bodies. A place is a mathematical point, a sort of *nothing*; what a wonderfully powerful *nothing* it would be that could act on bodies and attract them to itself! Actually, a body's tendency to rise or fall depends either on its microstructure or on its sympathy or agreement with some other body. If we can find any dense body that doesn't move towards the ground, that puts an end to this distinction—·i.e. this treatment of dense-down and light-up as the basic story about weight. *Can* we find such a body·? Well, if Gilbert is right that the earth's magnetic power extends out beyond the surface of the earth so far and no further, there will be heavy bodies

that it doesn't attract—and thus that don't fall downwards—because they are outside its sphere of influence. If we could find just one such body, that would give us an instance of alliance on the subject of weight. But we don't yet have any clear and uncontroversial example of this. The nearest we have to come to one, it seems, is with the waterspouts [Latin *cataractae coeli* = 'waterfalls of the sky'] that are often seen in the Atlantic Ocean. A waterspout suddenly discharges so much water, and with such force, that it seems that the water had gathered in that place ·in the sky· and to have •stayed hanging there until it was *thrown* down by some forceful cause—rather than to have •fallen by the natural motion of its weight. So we may conjecture that a dense and compact mass at a great distance from the earth would hang there like the earth itself until some cause pushed it down. But I am not confident about this. Note in passing that sometimes, as here, I can't produce clearly correct instances and have instead to fall back on suppositions for my examples. This shows how poor we are in natural history,

Or suppose we are investigating the nature of *intellectual activity*. The distinction between •human reason and •animal resourcefulness seems to be a perfectly correct one. Yet sometimes animals act in ways that seem to reflect logical thinking on their part. For example the old story of a crow which, half dead from thirst, saw some water in the hollow trunk of a tree, found the opening too narrow to get through, and proceeded to drop in pebbles until the water rose high enough for it to drink. This became proverbial.

[And one last example, an alliance challenging the supposedly deep division between light and colour.]

36. Class 14 of privileged instances: **signpost instances**, borrowing the term from the signposts that are set up at road-junctions indicating where the various roads go. I also call them 'decisive instances' [and he gives them three other names that don't occur again in this work]. I explain them thus. Sometimes when investigating a nature N the intellect is so balanced as to be unsure which of two or more natures it should take to be the cause of N (this happens because very often many natures occur close together). What a signpost instance does is to show that •one of the ·candidate· natures is linked with N firmly and unbreakably while •the other is linked with N only sometimes, erratically. That settles it: the former nature is accepted as the cause of N, while the latter is rejected. Such instances are very illuminating and have great authority; sometimes they provide the finishing touch that *completes* a process of interpretation. It sometimes happens that within a set of instances what we already know about one of them turns out to be a signpost instance, but most signpost instances are new, and have been deliberately looked for and uncovered only by hard clear-thinking work.

For example, suppose we are investigating the nature of the ebb and flow of the sea—which ebbs and then comes up again twice a day, taking six hours each time with slight variations in that corresponding to the motion of the moon. Here now is a road-junction.

This motion ·of the sea· *has to* be caused in one of these two ways:

(1) It is caused by the backward and forward motion of the waters; compare water sloshing back and forth in a basin, going up on one side as it goes down on the other.

(2) It is caused by the up and down motion of the waters; compare the rise and fall of boiling water.

Which of these two causes should be assigned as causing the ebb and flow of the sea? If we adopt **(1)**, we'll have to accept that when there is a high tide on one coast there must be at the same time a low tide on the other coast. So that is what

we investigate. Now careful observers have found that high tides on the Florida coast occur at the same time as *high* tides on the coasts of Spain and Africa, and low tides also occur at the same time on the two sides of the ocean. This seems decisively to rule out hypothesis **(1)** in favour of **(2)**, but on a closer look it turns out not to. For it can happen that a body of water is moving the same way and yet rises on the opposite shores of the same channel at the same time; all that is needed for this is that the water is being pushed along from some *other* direction. That's what happens when the level of a river rises because of water flowing in from the sea; the flow is in *one* direction, but the level rises on *both* banks. Perhaps something like that is happening with the tides. Perhaps a great mass of water from the Indian Ocean pushes into the basin of the Atlantic, thereby producing high tides on both sides at once. So we have to investigate whether there is anywhere for the water to be retreating and going down at the same time, ·because according to hypothesis **(1)** there can only be high tides somewhere if at the same time there are low tides *somewhere*·. Well, we have the Pacific Ocean, which is big enough for the purpose—it is actually bigger than the Atlantic.

Now at last we have reached a ·possible· signpost instance in this matter. If we find for certain that when there is a high tide on the coasts of Florida and Spain in the Atlantic there is also a *high* tide on the coasts of Peru and of China in the Pacific, then on the authority of this decisive instance we *would* have to reject the hypothesis **(1)** that the ebb and flow of the sea occurs by a forward motion; for there is nowhere for the forward-moving water to *come from*. (The easiest way to settle this would be to ask the inhabitants of Panama and Lima, where the Atlantic and Pacific are separated by a small isthmus, whether the high and low tides occur on the opposite sides of the isthmus at the same time, or whether instead a high tide on one coast is matched by a low tide on the other.) Now the outcome of this inquiry seems to settle the issue between **(1)** and **(2)**—*if we assume that the earth is immovable*. If the earth revolves ·on its axis·, however, it may be that the waters of the ocean are sometimes forced up into a pile which then collapses, letting the waters down again, all this being a result of differences (in speed or force) between the movement of the earth and the movement of the waters. This should be investigated separately. This hypothesis ·provides an alternative to the thesis that high tides on some coasts must coincide with low tides *on some other coasts*, but it· doesn't disturb the thesis that when the sea goes up somewhere it must go down *somewhere else*.

Now, suppose we have done what is needed to refute hypothesis **(1)** and have therefore accepted the hypothesis **(2)** that the tides come from the sea's rising and sinking. The inquiry into how that could happen is faced with a three-way fork in the road. (a) A large amount of water flows from the interior of the earth into the oceans, and then back again. (b) The amount of water in the oceans stays the same, but it changes in how dense it is, so that it can take up more space (high tide) or less (low tide). (c) The amount of water stays the same, and so does the amount of space it occupies, but portions of it are raised by some magnetic force attracting them from above and then by agreement letting them fall back again.

[Here 'agreement' translates the Latin *consensus*. Bacon quite often speaks of *consensus* between inanimate bodies, and he explains it on page **??** thus: 'Agreement ·between two things· is just a symmetry between the forms and microstructures of one and those of the other.' *Consensus* can also mean 'joint action', and it seems clear that Bacon at least sometimes thinks of it in causal terms. At the end of **31** he includes 'agreement between distant objects' in a short list of things that *may* have something real behind them but that 'lie buried deep beneath

a mass of lies and fables'; and his topic there seems to be *action* at a distance. If in our present example 'agreement' is meant causally, he is representing this magnetic attraction as involving causal input both from the magnet in the sky and from the water below. In this version of the work, *consensus* will be translated by 'agreement' throughout.]

Allow me to set aside (a) and (b), and look only into the question of whether (c) there is any such raising by agreement or magnetic force. First point: the waters lying in the bed of the sea can't all be raised at once, because there is nothing to take their place; so even if the waters did have such a tendency to rise, it would be blocked from having any effect by the way things hang together—uneducated people would say that it would be blocked 'so as not to create a vacuum'. So we are left with the thesis that the waters are raised in one place and therefore are lowered in another ·so as to flow in and take the place of the water that is raised·. And the thesis will have to be that since the magnetic force can't act on the whole ·body of the ocean's water· it must act with the greatest intensity on the middle, lifting the water in the middle while the rest falls away from the sides.

At last we come to a signpost instance on this subject. If we find that

> at low tide the surface of the water is more arched and round, with the waters rising in the middle of the sea and falling away at the edges, i.e. at the coasts, and at high tides the surface of the sea is flatter as the waters return to their former position,

then on the authority of this decisive instance we can accept the ·theory about· the raising of the waters by magnetic force; otherwise it must be utterly rejected. It wouldn't be hard to find out whether this is so, using sounding lines to discover whether at the times of ·coastal· low tides it really is deeper in the middle of the sea than it is at the times of high tides. Notice, incidentally, that if this *is* how things stand, then contrary to the common opinion the water rises in low tides and falls in high tides!

Or suppose we are investigating the nature of the spontaneous motion of rotation, and in particular the question regarding the daily motion in which it looks to us as though the sun and stars rise and set: Is it •a real rotation by the heavenly bodies, or •an apparent motion by them and a real motion of the earth? We would have a signpost instance for this topic if we found that:

- •There is some east-to-west movement (perhaps very faint) in the ocean, and
- •a similar motion is found to occur in the air and to be slightly faster (·we should look for this· especially in the tropics, where the larger circumference would make the movement easier to detect), and
- •the same motion, but now very lively and strong, is found in the lower comets, and
- •it is found in the planets, conforming to the pattern that the further a planet is from the earth the faster it moves, with bodies in the starry regions moving the fastest of all.

In that case we should accept that the daily motion really does occur in the heavens, and that it the earth doesn't take part in it. Why? Because it will be clear that •the east-to-west movement occurs throughout the cosmos, by the agreement of the universe, and that •it is fastest in the highest parts of the heavens and gradually becomes slower until eventually it stops, is extinguished, when it meets the unmoving part of the universe—namely the earth.

[Bacon's next two difficult paragraphs describe another supposed signpost instance for settling a different question about motion in astronomy. Then:]

Or suppose we are investigating the nature of weight or heaviness. Here the road branches into two:

> Heavy things either •tend of their own nature towards the centre of the earth because of their own microstructure or •are attracted by the bodily mass of the earth as an agglomeration of bodies of the same kind, being carried towards it by agreement.

If the latter of these is right, it follows that •the closer heavy things come to the earth the more powerfully they move towards it, and that the further away they are the more weakly and slowly they move (as is the case with magnetic attraction); and that •this ·attraction· is confined with certain limits, so that if something is so far away that the earth's power ·of attraction· couldn't act on it, it won't fall to earth but will rather remain suspended—like the earth itself! Here is something that would be a signpost instance ·at this junction·. Take a clock that is powered by leaden weights, and another powered by an iron spring. Ensure that neither goes faster than the other (check this carefully). Then place the weight-driven clock on the top of a very high steeple, keeping the other at ground level, and check whether the clock on the steeple goes more slowly than it did because of the lessened power of its weights. Then repeat the experiment in the bottom of a very deep mine, checking on whether the clock in the mine now goes faster than it did because of the increased power of its weights. If the weights are found to have less power on the steeple than at ground level, and more in the mine, this confirms that attraction by the mass of the earth is the cause of weight.

Suppose we are investigating the nature of the polarity of an iron needle that has been touched by a magnet. This leads to a two-way fork in the road: it must be the case that either

- •the touch of the magnet itself gives the iron a north-south polarity, or
- •the magnet merely activates the iron, preparing it to receive its motion from the presence of the earth.

Gilbert thinks the latter is right, and has worked hard to prove it. All his observations, collected with such alert intelligence, come down to two things. **(1)** An iron nail that has lain for a long time along a north-south line, untouched by a magnet, acquires north-south polarity. The idea is that the earth itself •activates the iron in the way the touch of a magnet would have done, and then •conforms the iron (now in its activated state) to itself, ·i.e. to the earth·, and makes it turn ·like a compass-needle·. It takes a long time to do this, Gilbert maintains, because of how far away the nail is ·from the part of the earth that activates and polarizes it·; according to him the surface or outer crust of the earth has no magnetic power. **(2)** If red-hot iron is allowed to cool while lying along a north-south line, it also acquires polarity without the touch of a magnet ·and without lying there for a very long time·. The idea here is that the particles of the iron are stirred into motion by the heat and then, while they are calming down as the iron cools, they are more than usually susceptible—more *sensitive*, as it were—to the ·magnetic· power emanating from the earth; so that that power is able to activate the iron. These are good observations, but they don't quite prove what Gilbert says they do.

Here is something that would be a signpost instance on this question: Take a magnetic globe [Latin *terrella* = 'little earth'] and mark its poles; then orient the globe so that the line between *its* poles is the earth's east-west and not its north-south line, ·the latter being of course the line between the big earth's poles·. Then place an untouched iron needle on top of the globe, ·lying in the earth's north-south line·, and let it stay there for about a week. While it is there, the needle will swing away from the earth's north-south line and align itself with the line between the poles of the globe, ·the little earth·; there is no doubt about this. So there is the needle, lying on

the globe and pointing east-west. Now take the needle right away from the globe, and put it on a pivot ·that will let it rotate, as did the surface of the globe·. •If it then, suddenly or gradually, aligns itself north-south, then ·that settles it·: its polarity is caused by the earth. •If on the other hand the needle aligns itself east-west as it did on the globe, or loses its polarity altogether, that casts doubt on the thesis that the earth causes the polarity, and further investigations are needed.

[Then two paragraphs about possible signpost instances for the question 'What is the moon made of—is it light and airy or solid and dense?' Then:]

Or suppose we are investigating the nature of the motion of projectiles (javelins, arrows, balls, etc.) through the air. The ·Aristotelian· schoolmen have—of course!—dealt with this very carelessly. [Re this next bit, see page 18.] They have thought it enough

- •to label it 'violent motion' as distinct from what they call 'natural motion' ·such as the motion of a falling body·, and
- •to account for the start of such motion in a collision by the axiom that two bodies can't be in the same place ·at the same time· because matter is impenetrable.

That explanation ·tells us that when body x bumps into body y it doesn't melt into it·, but the schoolmen don't concern themselves with what happens *after* the moment of collision. The two-way fork in the road on this question goes as follows. Either

- •this motion occurs because the air carrying the moving body collects behind it, as a stream does in the case of a boat. . . .or
- •it occurs because the parts of the body don't stand up to the collision but rather push forward in succession to get away from it.

The former view is adopted by. . . .nearly everyone who has looked into this kind of motion with any care, and there is no doubt that the air has *something* to do with it; but countless experiments show that the other account is certainly the true one. Here is just one of them, a signpost instance on this subject: Take a thin iron plate or a stiff piece of iron wire,. . . . bend it into a curve between your finger and thumb, ·and then remove your thumb·; the iron will spring away. Obviously this motion can't be attributed to air gathering behind the body, because the source of motion is in the middle of the piece of iron not at its end.

[Then two paragraphs about the explosion of gunpowder: is this just a case of the general phenomenon of *hot things expanding* or is there more to it? Bacon thinks there is more to it, and cites a couple of signpost instances that he says point that way. Then:]

Or suppose we are investigating the transitory nature of flame, its capacity for being quickly snuffed out. It seems that here in our world there is nothing fixed and stable about flame; it is generated at every moment and then instantly extinguished. When we see something going on burning for a long time, what we see throughout that time is not •the very same individual flame, but rather •a series of new flames generated one after another. That it's not the same individual flame all through is easily seen from the fact that the flame instantly dies when its fuel, its nourishment, is taken away. Here is a two-road fork in this investigation: the short-lived nature ·of flame· comes either from •the stopping of the cause that first started it (as with the short-livedness of light, sounds, and the so-called 'violent' motion ·of projectiles·) or from •the flame's being intrinsically able to continue in our world but being destroyed by the so-called 'violence' it meets with from contrary natures that surround it. ·Briefly, this is a choice between •'The flame is *allowed* to go out' and •'The

flame is *made* to go out'·. Here is a possible signpost instance on this road. [Bacon's account of the signpost instance that is supposed to favour the second of the two hypotheses, is hard to make understandable without breaking away from his wordings. The gist of it is this: Flames are pyramids; the broader a flame is at its base, the higher it leaps. Flames at the centre of the pyramid are surrounded by other flames, and thus aren't under attack from •anything else that works against flame; but flames around the edge are constantly under attack from •the surrounding air, which is why the column of flame gets thinner the higher it goes. Three other details should be reported. **(1)** The flame going up the centre of the pyramid is numerically the same flame throughout, not a succession of short-lived flames. (This seems not to be an essential feature of the signpost instance.) **(2)** Air is receptive to smoke, just as it pushes against flame. That is why smoke forms an *inverted* pyramid. **(3)** One upshot of all this is the untenability of the idea that flame is just burning air.]

[Then Bacon offers a second more precise signpost instance. Then:]

That is enough about signpost instances. I have spent so long on them so that men may gradually get into the habit of judging natures by signpost instances and illuminating experiments, rather than by probable reasoning.

37. Class 15 of privileged instances: **instances of separation**, which indicate the separation of natures that commonly occur ·together·. Because they concern the separation of one nature from another *nature* they are different from the instances ·of enmity· that I presented along with the instances of friendship [in **33**, page 83], in that the latter concern the separation of a nature from some *concrete thing* that ordinarily has it. They differ from signpost instances because they don't *settle* anything, but merely point out the separability of one nature from another. What they are good for is to detect false forms and to blow away flimsy theories suggested by what lies on the surface. You could say that they add leaden weights to the intellect [see [1]**104**].

Suppose for example that we are investigating the four natures that Telesio regards as always going together, namely

> heat, brightness, rareness, mobility or readiness for motion.

[Here as elsewhere 'rare' means thin, finely divided, like a fluid or a gas.] We find many instances of separation amongst these. For air is rare and mobile, but not hot or bright; the moon is bright without heat; boiling water is hot without light; the motion of a compass needle is quick and agile though the needle is cold, dense, and opaque; and there are many more of this kind.

Or suppose we are investigating corporeal nature and natural action. It *seems* that natural action isn't found anywhere except in some body; but here too we may be able to find some instance of separation—for example, magnetic action by which iron is drawn to the magnet and heavy bodies are drawn to the globe of the earth, and there may also be other operations that are performed at a distance ·and are therefore not wholly *in* any body·. For action at a distance

> takes some period of time (it doesn't happen in an instant), and operates across some stretch of space. . . .

So there must be some moment M and some location L such that the power or action passes through L at M, and is at that moment suspended *between* the two bodies that are causing the motion. So the question we have to face is this: Is the following the case?

> •The ·two· bodies that are the terminals of the motion organise or modify other bodies that are between them, so that the force passes from one terminal body

> to the other through a series of actual contacts ·and doesn't involve *action* that isn't in any body·;

Or is the situation rather the following?

> •There are no ·relevant· intermediate bodies; all we have are the ·terminal· bodies, the force or power or action, and the space, ·in which case there is *action* that isn't in any body·.

In rays of light, sounds, heat and certain other things that act at a distance, it's probable that intermediate bodies are organized and altered, especially because they don't work unless there is a suitable medium to carry the force. But magnetic or attractive force works with any kind of medium; there is no medium that blocks or lessens it. And

> if •the power or action has nothing to do with any intermediate body, it follows that •there is a natural force or action existing at some time and *in some place* without being *in any body* (since it isn't in the terminal bodies or in any intermediate body).

So magnetic action may be an instance of separation between corporeal nature and natural action. [The remainder of this paragraph alters the order of Bacon's text but not its content.] And there is an **important corollary**, which I now expound. Consider these two propositions:

> **(1)** Only bodies can *transmit* natural action.
>
> **(2)** Only bodies can *generate* natural action.

They both look to be true, ·and one would think they stand or fall together·. But now we have found evidence that

> natural power and action can be generated by a body and then operate at some time in some place entirely without any body,

which falsifies proposition **(1)**. And when you deny **(1)** you aren't far from denying **(2)**, which amounts to allowing that

> there are entities and substances—·things that can act·—that are neither made of matter nor *in* matter.

It is remarkable that this case for **the existence of incorporeal substances** comes merely from human empirical science.

38. Now we come to five types of instances that I lump together as 'torchlight instances'. They are instances that help the senses. All interpretation of nature starts with the senses, and leads by a straight, regular, and secure road from •perceptions of the senses to •perceptions of the intellect, which are true notions and axioms. So, inevitably, the fuller and more accurate the representations or offerings of the senses are, the more easily and well everything will go.

Of these five ·classes of· torchlight instances, •the first strengthen, enlarge, and correct the immediate actions of the senses; •the second bring within reach of our senses things that we ·initially· don't sense; •the third indicate ·the whole extent of· continuous processes of which we usually observe only the beginning, the ending, or episodes along the way; •the fourth provide a substitute for the senses when they utterly fail; the •fifth attract the attention of the senses, making them *attend*, and at the same time set bounds to the subtlety of things. I shall now take these up one at a time. [Regarding the second of those: Bacon wrote *deducunt non-sensibile ad sensibile*, which literally means something like 'they lead non-sensible things to being sensible'. When the language of 'bring(ing) within reach' occurs in the next few pages, it will always be a translation of something using the verb *deduco* or the related noun *deductio*.]

39. Class 16 of privileged instances: **door-opening instances**, this being my name for instances that help the immediate actions of the senses. It's clear that eyesight is the most informative of the senses, and is therefore the one that it's especially important to find help for. There seem to be three kinds of aid to eyesight—ones that enable us **(1)** to see things that we now don't see, **(2)** to see things at a great

distance, **(3)** to see them more exactly and distinctly. [When Bacon writes about (1) glasses that greatly increase the apparent size of small objects and (2) glasses that bring us into a closer relation with the stars, he is referring of course to (1) the *microscope* and (2) the *telescope*, and those words—which didn't become standard English for another few decades—will for convenience be used in this version.]

(1) The first kind are microscopes—invented not long ago—which greatly increase the apparent size of small objects, thus revealing their hidden, invisible little details and their hidden microstructures and processes. Microscopes enable us to see the exact shape and bodily details of a flea, a fly, a worm, and amazing colours and motions that we had never before seen. It is said that a straight line drawn with a pen or pencil is seen through a microscope to be quite crooked, because neither the motion of the hand (even when aided by a ruler) nor the impression of the ink or pigment is really smooth, though the unevenness is on such a small scale that it can't be detected without such glasses. Some people say that

> microscopes •do honour to the works of nature but •discredit artifacts.

But the truth of the matter is just that

> microscopes •are illuminating about things that have very fine microstructures and •not about things that don't;

and natural things are of the former kind and artifacts of the latter. (·To believe that a *glass* can detect the difference between what's natural and what's artificial· is an instance of something that usually comes into play when a new and wonderful discovery is made—namely *superstition*!) Thus, microscopes are good only for tiny things; if Democritus had seen one he'd have jumped for joy, thinking that a way had been found for seeing atoms, which he had declared to be altogether invisible. However, just because they do their work only when applied to tiny things—and not even for *them* when they are parts of larger bodies—microscopes aren't actually much use. If they could be applied also to larger bodies, or to small parts of larger bodies, so that the texture of a linen cloth could be seen as a net and we could discern the hidden micro-features of gems, liquids, urine, blood, wounds and many other things, that undoubtedly *could* lead to great benefits. (Incidentally, in dealing with this first kind of door-opening instance, I haven't mentioned spectacles—·the sort that people wear·—because they serve only to alleviate defective vision, and aren't ways of getting new information.)

(2) The second kind are telescopes, those other glasses discovered through the memorable efforts of Galileo—glasses that let us develop and maintain a closer relation with the heavenly bodies, as though we could row or sail over to them. Telescopes show us that the Milky Way is a group or cluster of entirely separate and distinct small stars—something that the ancients could only *suspect*. They seem also to show that the spaces of the so-called planetary orbits do have some stars in them, so that the heavens begin to be starry—though with stars too small to be seen without a telescope—before we come to the 'starry heavens'! The telescope lets us see the little stars wheeling as in a dance round the planet Jupiter (from which we may conjecture that there are several centres of motion among the stars). It lets us see and locate the different light and dark parts of the moon, of which we can make a kind of map of the moon. It lets us see spots on the sun, and other such things. These are all splendid discoveries, insofar as we can safely credit such demonstrations. I am in fact very suspicious of them, because their empirical results stop at these few things; they haven't led to discoveries concerning many other things that are equally worthy of investigation.

(3) Of the third kind are rods for measuring parts of the earth, astrolabes ·for measuring the heights of stars·, and the like. These don't •enlarge the sense of sight, but •correct it and •point it in the right direction.

If there are instances that aid the other senses in their immediate individual actions, but don't add anything to the information already possessed, they aren't relevant to my present concerns, which is why I haven't mentioned them.

40. Class 17 of privileged instances: **summoning instances**, borrowing the name from the civil-law courts, which

> •summon things to appear •that haven't appeared before. . . .

·Analogously·, these instances

> •bring within reach of our senses things •that we ·initially· don't sense.

An object may escape the senses because

(1) it is too far away, or
(2) there are bodies between us and the object, or
(3) the object isn't fit to make an impression on the senses, or
(4) there isn't enough of the object to affect the senses, or
(5) there isn't time for the object to affect the senses, or
(6) the sense-organs can't tolerate the impression of the object, or
(7) the sense is already taken up by another object and has no room for motions caused by this one.

These mainly concern sight, and secondarily touch; for those are the senses that give a wide range of information about •objects in general; the other three senses give hardly any information except immediate information about •objects that are special to each sense.

(1) When an object can't be perceived because it is too far away, the only way to bring it within reach of the ·relevant· sense is to connect it with (or replace it by) some other object that *can* strike the sense from a greater distance—as in spreading news by beacons, bells, and the like.

(2) When the inside x of an object y is concealed from the senses by the part of y that surrounds x, and y can't easily be opened up, x can be brought within reach of the senses by parts of y that lie on its surface or come to its surface from the inside. That is how the condition of the ·whole· human body is known from the state of the pulse, the urine, etc.

(3, 4) The next two kinds of bringing-within-reach apply to ever so many things, and in our investigations of things they should be looked for everywhere. Here are some examples, ·which will occupy the next three pages·.

Air and spirit and other things that are also rare and subtle throughout obviously can't be seen or felt by touch. In investigating bodies like these, it is utterly necessary to resort to devices for bringing within reach. Suppose we are investigating *the spirit enclosed in tangible bodies*, wanting to discover what its nature is and how it acts. Everything tangible in our environment contains an invisible and intangible spirit which it envelops and clothes. This is the source of three powerful and wonderful effects that spirit brings about in a tangible body. If the spirit in a tangible substance is (a) discharged,

> it shrinks the body and dries it up;

if it is (b) ·completely· kept in,

> it softens the body and makes it melt;

if it is (c) partly discharged and partly kept in,

> it shapes the body, gives it limbs, absorbs, digests, excretes, organizes, and so on.

And all these processes are brought within reach of the senses through their conspicuous effects. ·In the next three paragraphs I shall describe the processes in more detail·.

(a) In every tangible inanimate body the enclosed spirit first •multiplies and then feeds on the tangible parts that are readiest and nearest at hand for that purpose, digests and dissolves them and turns them into spirit; and then they—the spirit that was originally there, and the extra spirit that has been made from tangible parts of the body—•escape together. ·The two parts of this total process are brought within reach of the senses in different ways·. •The multiplication of the spirit and its dissolving of tangible material are brought within reach of the senses by *loss of weight*. Whenever something dries up, there is some decrease in its quantity. I'm not talking about the quantity of spirit that was previously there (because that's irrelevant, as spirit doesn't weigh anything). I'm talking about the tangible material that the body loses because it is turned into spirit. •The discharge or release of the spirit is brought within reach of the senses in the rusting of metals and other similar kinds of going-bad (but don't follow this line of thought out to bodies that start to qualify as *living*, for they involve (c) the third kind of process). What happens in compact bodies is that the spirit finds no pores or passages through which to escape, so it has to *force* its way out, driving tangible parts of the body before it so that they leave the body—as rust or whatever—when the spirit does. The discharge of spirit leaves the tangible body drier than it was, and more condensed; and these changes are brought within reach of the senses by the increased hardness of the body but much more by its splitting, shrinking, wrinkling and folding in on itself. . . .

(b) Contrasting with that: when the spirit is kept in while being expanded and stirred up by heat or something like it (as happens to very dense and hard bodies), then the body becomes soft, like red-hot iron; or it becomes ·even softer, so that it is · able to flow, like a ·white-hot· metal; or it becomes liquid, as do gums, wax etc. So we can easily reconcile the opposite effects of heat, which hardens some things and melts others. When it hardens:

> the spirit is discharged, and the hardening is the action of the tangible parts that are left behind;

and when it softens ·or melts·:

> the spirit is stirred up and detained, and the melting is caused by the action of the heat and spirit.

[The next two sentences considerably expand something that Bacon clearly intends but says with drastic brevity.] In the melting case, the tangible parts and the spirit are both actively at work in the melting. In the hardening case, the tangible parts do all the work, and the discharge of the spirit figures only as the *occasion* for this—not a partial cause but merely a trigger that releases the cause.

(c) But when the spirit is neither wholly kept in nor wholly discharged, but only tries things out within its boundaries and comes across tangible parts that are obedient and ready to follow, so that they do follow wherever it leads, what that leads to is the forming of an organic body, the development of organs, and all the other life-processes in plants and in animals. What brings these processes within reach of the senses is mainly careful observation of the first beginnings of life—the elements or first attempts at life—in little animals that are generated from putrefaction—ants' eggs, worms, flies, frogs after rain, and so on. For life to start, ·two more things are required·. •There must be gentle heat [*lenitas caloris*], so that the spirit isn't rushed into breaking out from the body. And •the body must be flexible [*lentor corporis*], so that the spirit isn't prevented by the stiffness of the parts from folding and moulding them like wax.

Again, there are many bringing-within-reach instances that set before our eyes that most remarkable and far-reaching trichotomy of spirits:

- •isolated spirit [or perhaps: 'spirit cut short']—the spirit of all inanimate substances,
- •simply branching spirit—the spirit of plants,
- •spirit that is both branching and cellular—the spirit of animals.

[There are no further mentions of this trichotomy or any of its members.]

It's obvious that the more fine-grained textures and microstructures of things (even when the body as a whole is visible or tangible) are not perceptible either by sight or by touch. So we get our information about these also through their being *brought* within reach of our senses. Now, the deepest and most basic difference between microstructures depends on how much or how little matter there is in a given stretch of space. All other microstructures, which have to do with the spatial relations amongst the qualitatively different parts of a body, are secondary to this one.

Suppose, then, that we are investigating ·this most fundamental topic·, the nature of the expansion or contraction of matter in bodies, i.e. ·what it is that settles· for each body how much matter it contains in how much space. ·In exploring this, we shall be guided by three important propositions, of which the first is really two in one·. Nothing is truer in nature than the twin propositions:

- •Nothing comes from nothing. •Nothing is reduced to nothing.

This is to say that any given portion of matter—or the sum total of all matter—remains unchanged, not getting larger or smaller. It is equally true that

- •How much matter a given region contains varies according to what kind of body it is contained in.

For example, a given region would contain more matter when completely filled with water than it would when completely filled with air. So that to assert that a given volume of water can be *changed into* an equal volume of air is tantamount to saying that something can be reduced to nothing; and conversely to say that a given volume of air can be *changed into* an equal volume of water is tantamount to saying that something can come from nothing; ·though of course a given volume of water (air) can be *replaced by* an equal volume of air (water)·. The notion of the *denseness* or *rareness* of matter—so widely accepted and so variously understood!—should properly be based on ·this difference in· how much matter there is in this or that region. We should also work with a third proposition which is also quite certain:

- •There are ways of making exact—or nearly exact—numerical comparisons between the amount of matter in one body and the amount in another.

So there is nothing wrong with saying ·for instance· that the amount of matter in a cubic foot of gold is the same as the amount in twenty-one cubic feet of alcohol.

Now, amounts and proportions of matter are brought within reach of the senses by means of *weight*, because •weight corresponds to •amount of matter. (In the thing's tangible parts, that is. A thing's weight doesn't let you calculate how much spirit it contains, because adding spirit to a thing makes it lighter, not heavier.) I have drawn up a pretty accurate table on this subject, in which I have recorded the weight-per-volume of each of the metals, the principal stones, woods, liquids, oils, and most other bodies, natural as well as artificial. This has all sorts of uses, theoretical and practical; and much of what it reveals is quite contrary to expectation. One significant upshot of it is this: Setting aside bodies that are spongy and hollow and chiefly filled with air, and attending only to compact bodies, we can say that all the ones that much concern us lie within the range 1-21, that is, the most dense of them is 21 times as dense as the least dense.

I have also thought it worthwhile to try to find out the ratio of intangible bodies to tangible ones. Here is the experimental set-up that I used. I took a glass bottle that could hold about an ounce (keeping it small so that less heat would be needed to produce evaporation). I filled it with alcohol almost to the brim (selecting alcohol because. . . .it is the least dense—contains the least matter in a given volume—of all tangible bodies except ones that contain pores and hollows). Then I took careful note of the weight of the spirit and bottle together. Next I took a bladder with about a quart capacity, squeezed it flat, getting out as much of the air as possible; having previously rubbed grease into it, to block any pores it might have. I tightly tied the mouth of the bladder over the opening of the bottle. . . . Then I put the bottle above a pan of hot coals. Before long a steam or breath of the alcohol, expanded and made gaseous by the heat, inflated the bladder so that it bellied out in all directions like a sail ·with the wind in it·. Then I immediately took the glass off the fire and put it on a carpet so that it wouldn't be cracked by the cold ·of a bare floor·, and punctured the bladder ·to let the gas escape·, so that none of the gas would liquefy upon cooling, ·run back into the bottle·, and so spoil the measurement. I then removed the bladder ·from the bottle· and weighed ·the bottle and· the alcohol that remained, calculating how much had been converted into gaseous form. That of course enabled me also to calculate what *volume* that portion of the liquid had had in the bottle. Then comparing that volume with the volume of the inflated bladder, I calculated the ratio, which showed clearly that the material's change from liquid to gas multiplied its volume by a hundred.

[Then a brief repeat of what Bacon said earlier [item 38 on page 64] about thermometers, this time stating it in terms of bringing very small differences of temperature within reach of the senses. Then:]

Suppose we are investigating the nature of the *mixtures* of bodies—what they contain of water, oil, spirit, ash, salt, and the like; or (to take a particular case) what milk contains of butter, curd, whey and so on. For •tangible elements, ·the proportions of· these mixtures are brought within reach of the senses by skillfully contrived separations. The nature of the •spirit in them, though not immediately perceived, is discovered by the different motions and efforts of the tangible bodies in the very act and process of their separation, and also by how corrosive or acidic they are, and by the various colours, smells, and tastes that the bodies have after separation. This is a part of the task at which men have worked hard with their distillations and controlled separations, but with not much better success than in their usual kinds of experiments: groping around, moving in the dark, putting in more effort than intelligence, and (worst of all) not trying to imitate ·the gentle ways of· nature but instead using high heat and unduly strong forces which destroy all the delicate microstructures that are the main source of the hidden powers and agreements of things. [Bacon then repeats a warning given in on page 53 about testing a substance by means that alter it. Then:]

Quite generally, all our refined ways of testing bodies, whether natural or artificial—to distinguish pure from adulterated, better from worse—belong *here*; for what they do is to bring within reach of our senses things that we ·initially· don't sense. So they should be sought and collected from all quarters with diligent care. [The ensuing '(5)' relates to the list on page 95.]

(5) The fifth way in which objects escape the senses is this:

> Obviously the action of the senses occurs as motion, and motion occurs in time. So if a body moves vastly slower or vastly quicker than the movements involved

in the ·relevant· action of the senses, the body isn't perceived at all.

For example, the motion of a clock-hand, the motion of a speeding bullet. Motion that is too slow to be perceived is easily and usually brought within reach of the senses by considering long stretches of it. Motion that is too quick hasn't yet been competently measured, but sometimes the investigation of nature requires that this be done.

(6) In the sixth kind, where the sense doesn't represent the object properly because the object is too powerful for it, the object can be brought within the sense's scope by •increasing the distance between it and the object, or •dulling the object's effect by interposing something that will weaken but won't annihilate the ·effect of the· object; or •accepting the less powerful impression of a *reflection* of the object—like seeing the sun reflected in a basin of water.

(7) The seventh kind of case where an object isn't sensed, namely where the ·relevant· sense is so occupied with some other object that it has no room to let this one make itself felt, is pretty much confined to the sense of smell and has little to do with the matter in hand.

That's all I have to say about procedures for bringing things that we ·initially· don't sense within reach of our senses.

Sometimes a thing is brought within reach of the ·relevant· sense not of a man but of some other animal in which this sense is keener than it is in man. For example: bringing certain smells to the sense of a dog; bringing light to the sense of a cat, an owl, and other such animals that see in the dark. (This second example concerns the light that is latent in air that isn't lit up from outside itself. Telesius has rightly observed that there *is* in the air itself a kind of original light, though it's faint and weak not much use to the eyes of men or most animals. His reason is that some animals see in the dark, and he thinks they are ones whose sense of sight is able to pick up this light; for it is hardly credible that they see without any light at all or that they see by a light that comes from within them.)

It's important to take in that my topic has been *deficiencies* of the senses and their remedies. The *errors* of the senses should be dealt with in investigations of sense and the objects of sense. Except for the *great* error of the senses, namely that they draw the lines of nature on the pattern of man and not of the universe [see [1]**41** on page 9]; and this can be corrected only by reason and universal philosophy, ·not by empirical scientific investigations·.

41. Class 18 of privileged instances: **instances of the road**, which I also ·though not again in this work· call 'travelling instances' and 'jointed instances'. They call attention to the processes of nature *while they are going on*. These instances are ·remedies for· failures to •attend rather than failures to •perceive. Men are surprisingly careless in these matters, ·especially the processes in which organic bodies come into being·. They study nature on and off, attending when the bodies are finished and completed but not while nature is at work on them. But if you wanted to see and think about the techniques and procedures of a craftsman, you wouldn't settle for merely seeing his raw materials and his finished products; you would want to be there while he was *working towards* completing the product. Well, it's like that with ·the investigation of· nature. For example, if we are investigating the life-processes of plants, we must begin from the time when the seed is sown. (That's not hard to do: you just take up and carefully examine a few seeds each day after the first.) We should note how and when the seed begins to swell and to fill up with spirit; then how it begins to burst and put out shoots, at the same time raising itself a little unless the

soil is too resistant; then how it puts out its shoots, some downwards for the roots and some upwards for the stems, sometimes also creeping sideways if it can find easier soil in that direction; and a good many other things of that sort ·should be done·. In the same way we should examine the hatching of eggs, where we can easily observe the whole process of coming alive and getting organized , what parts come from the yolk and what from the white of the egg, and so on. Similarly with the ·tiny· animals that come into being from putrefaction. (It would be inhuman to investigate complete ·large· animals in this way, cutting the foetus out of the womb; though miscarriages and animals killed in hunting offer some opportunities.). . . .

The same thing should be tried with inanimate things, as I myself have done in investigating the expansion of liquids by fire [item (a) on page 96]. For water expands in one way, wine in another, vinegar in a third. . . . It would easy to show this by putting them in a clear glass vessel and boiling them over a slow fire. But I'm only touching on these matters briefly here; I plan to treat of them more fully and exactly when I come to the discovery of the hidden processes of things. Please understand that all I am doing here is to give examples—I'm not dealing with the things themselves.

42. Class 19 of privileged instances: **instances of supplement or substitution**, also called 'instances of last resort'. When the senses don't provide us with any proper instances, we get information by resorting to these ·members of class 19·. There are two ways of making a substitution. (a) •By degrees: Here is an example. We don't know of any medium that entirely blocks a magnet's effect on iron; the effect isn't stopped by interposing gold, silver, stone, glass, wood, cloth or other fibres, air, flame etc. But if we're careful we may be able to show that some medium blocks *more* of the magnet's power than any other—this being a difference of degree. . . . Again, we haven't found any ·kind of· body that isn't warmed by being brought near a fire; but air heats up *faster* than stone. That's substitution by degrees.

(b) •By analogy: Though certainly useful, this is less sure ·than substitution by degrees·, so it should be used with discretion. It's what we use when something that isn't directly perceptible is brought within reach of the senses not through

> ·observation of· the perceptible activities of the body that isn't perceptible in itself,

but rather through

> observation of some related body that *is* perceptible.

[Bacon then gives an example, which is extremely hard to follow. The present version keeps all its content, and adds nothing; but it does rearrange the materials considerably.] For example, suppose we are inquiring into a mixture of spirits (which are invisible bodies)—specifically into the mixture of •air and •flames. The related bodies that will give us our instance of substitution are •water and •oil, which seem to be related to air and flames respectively by being *fuel* for them. (Flames grow when they are above fumes from oil, and air grows when it is above water vapour.) Our senses won't show us the mixture of air and flame, so let us look instead at the mixture of water and oil—something that our senses will let us do. Now our senses tell us this:

> Oil and water •don't mix well when they are merely shaken up together, but they •mix fully and smoothly when they are ingredients of plants, blood, and the parts of animals.

So something similar *may* be the case with the mixture of flame and air in spirits, namely:

> •When flame and air are simply mixed, they don't stay mixed; but •when they're mixed in the spirits of plants and animals they do mix ·in a more durable way.·

·That is our substitution instance. It gets some independent confirmation from the fact that· all living spirit takes both watery and fatty substances as its fuel.

Or suppose that what we are investigating is not more or less perfect mixtures of spirits but simply how ·different kinds of· spirits intermingle. •Are they ·all· easy to mix so that they incorporate one another? •Or is it rather the case that *some* winds and vapours and other spirits don't mix with ordinary air, but remain suspended and floating in it in blobs and drops that and are smashed by the air rather than welcomed and incorporated? With ordinary air and other spirits we can't answer this by consulting our senses because these spirits are too subtle—·too finely divided·—for our senses to be able to register them. Still, we may get some idea of what happens in those cases by looking at analogous cases involving ·pairs of liquids or· liquids ·and air· which come together but don't incorporate one another:

- •mercury ·and just about anything·,
- •oil and water,
- •air and water (note how air breaks up and rises in little bubbles when dispersed in water),
- •·air and· the thicker kinds of smoke, and lastly
- •air with dust suspended in it.

This is not a bad way of looking at the matter ·of combinations of spirits·, provided that we first check carefully into whether there *can* be such a heterogeneity—·such an unevenness of mixing·—in spirits as well as in ·some· liquids ·in relation to other liquids or to air·. If there can be, then there is nothing wrong with substituting these images by analogy ·for the spirit-to-spirit combinations that are our real topic·.

But with regard to these instances of supplement, although I said that information can be derived from them as a last resort in the absence of proper instances, please understand that they are also of great use even when proper instances are available, because they can confirm what we learn from the proper instances. I'll discuss them more fully when I come in due course—·though not in the present work·—to speak of the Supports of Induction.

43. Class 20 of privileged instances: **dissecting instances**, so-called because they dissect nature. They could be called 'Democritean instances' ·in honour of Democritus, whose metaphysic dissected nature right down to its smallest elements, the atoms·. I also call them—·though not again in this work·—*nudging* instances, because they nudge the intellect to make it aware of nature's wonderful and exquisite fineness of grain, stirring it up to pay attention, to observe, to investigate. Here are some examples:

- •a little drop of ink can make so many letters or lines;
- •a piece of silver gilded only on the outside can be drawn out to such a length of gilt wire;
- •a tiny worm such as we find in the skin has spirit and a complex structure;
- •a little saffron colours a whole barrel of water;
- •a little civet or spice fills a much larger volume of air with its aroma;
- •a little fumigating powder creates such a cloud of smoke;
- •fine-grained differences of sounds such as are involved in spoken words carry in every direction through the air and even (in weakened form) through the holes and pores of wood and water, and are moreover echoed back—all this being done so clearly and quickly;
- •light and colour pass so quickly and at such distances through solid bodies of glass and water, or are refracted by them or reflected back from them, all this with such an exquisite variety of images;

- the magnet acts through bodies of all sorts, even the most dense.

Even more wonderful is the fact that in all these events, passing as they do through a non-interfering medium such as air, the action of one thing doesn't much interfere with the action of another. That is to say that the spaces of the air carry so many images of visible things, so many impressions of voices speaking, so many different colours, as well as heat and cold and magnetic influences—doing all this, I repeat, at the same time and without getting in one anothers' way, as though each kind of influence had its own private paths that the others couldn't get into.

[A paragraph saying that this non-interference applies only between influences of different kinds. A strong light can drown a weak one, a cannon's noise can obliterate the sound of a voice, etc. Bacon says he will discuss all this when he gets to the supports of induction—which he doesn't get to in this work.]