The philosophy of social science : an introduction /Martin Hollis; New Delhi: Cambridge University Press, 2000 (22-39 p.)

Is Understanding then committed to some form of relativism, for good or ill? Chapter 10 makes this question the occasion for asking whether value-neutrality in the social sciences is possible or desirable. Weber is again pressed into service, this time to present the official view that, although the social sciences are bound to be 'value-relevant', they can and should be conducted in a way which is 'value-free'. But, the more we think about this line, the harder it becomes to keep to it. Chapter 11 therefore broadens the discussion. The Problem of Other Minds involves other forms of relativism, as becomes plain when we consider anthropologists seeking to understand other cultures. Possible limits to relativism are examined, in search of an escape from the notorious 'hermeneutic circle'.

The concluding chapter reflects on what we have found on this journey, which it is now time to begin.

CHAPTER 2

Discovering truth: the rationalist way

Sir Francis Bacon, often hailed as the father of modern scientific method, distinguished two ways of discovering truth. In his *First Book of Aphorisms*, published in 1620, he declared:

> There are and can be only two ways of searching into and discovering truth. The one flies from the senses and particulars to the most general axioms, and from these principles, the truth of which it takes for settled and immovable, proceeds to judgement and the discovery of middle axioms. And this way is now in fashion. The other derives axioms from the senses and particulars, rising by a gradual and unbroken ascent, so that it arrives at the most general axioms last of all. This is the true way, but as yet untried.

The truth to be searched into was truth about nature, meaning the universe as God had created and furnished it. Both ways were ways of discovering the true order in nature by applying Reason scientifically. They differed sharply in their analysis of Reason and how to apply it, but they agreed on the project, that of constructing a new science based on absolutely certain truths. New ideas of Reason were accompanied by new ideas of nature and led to new ideas about human nature and society.

I start in the seventeenth century because that is when our modern intellectual world coalesced. The scientific revolution was already in full progress. In astronomy, for instance, telescopes wielded by Kepler and Galileo had long since smashed the crystal spheres, once believed to rotate around the earth. But it took some time for thinkers to realise that the new science was so systematically at odds with the old that nothing could be taken for granted. In the old story of heaven and earth everything had been found a meaning, purpose, reason, function and cause, so

that the story made sense on many levels together. In the new, as it gradually emerged, the universe was a mechanically ordered system, like a perfect watch. Science could discover the causes and functions of its parts without being concerned about the purpose or meaning of the whole. Admittedly the divorce between causes and meaning was not immediate. After all, a perfect watch is designed by a perfect watchmaker for a purpose. But the new notion of Reason did presently lead to this modern divorce.

The symbolic moment (with hindsight) was when René Descartes (1596–1650) marked 'the first knowledge' or certain starting point for his new philosophy, with the famous words *cogito ergo sum*, usually translated 'I think, therefore I am'. They come from his *Meditations on First Philosophy* published in 1641, where he set out to ground all knowledge in basic truths and principles accessible to a rational mind. If he cleared his mind of all preconceived ideas and of everything which he had come to accept on authority, could he be sure of anything? Yes, pure reflection guaranteed that at least one reflective mind existed, namely himself. It also guaranteed a self-evident principle – that anything self-evident is thereby true. Since 'first philosophy' included knowledge that God exists, no conflict between science and religion was intended. But, all the same, by removing the imprimatur of Reason from all traditional authorities and giving it to every reflective individual with an open mind, Descartes laid the ground for a secular science, which would be neutral on questions of meaning and value.

The 'moral' and social sciences did not take shape in earnest until the mid-eighteenth century. But, when they did, it was against a background of revolutionary scientific thinking about nature, crucial for how they have developed. In particular, naturalism is compelling, if, as La Mettrie put it in his instructively titled book *L'Homme Machine* (1747):

> Man is not fashioned out of a more precious clay; Nature has used only one and the same dough, in which she has merely varied the leaven.

The mood was caught by this memorable question from Condorcet's (1795) *Sketch for a Historical Picture of Progress of the Human Mind*:

> The sole foundation for belief in the natural sciences is this idea, that the general laws dictating the phenomena of the universe are necessary and constant. Why should this principle be any the less true for the development of the intellectual and moral faculties of man than for the other operations of nature? (1795, Xth Stage)

As Bacon suggests, however, there have long been deep disputes about the character of Reason and the proper method of science. The one which Bacon mentions is between those who start from 'the most general axioms', now known as rationalists, and those who start from 'the senses and particulars', now known as empiricists. Rationalism is no longer much in favour, but it remains important for its attempt to give theoretical reasoning the task of identifying hidden structures and laws, as this chapter will show. Empiricism has fared better of late and will be examined under the heading of Positive science in the next chapter. Crucially for both chapters, Bacon's two ways of searching into truth both presume that scientific knowledge can be found a settled and unmovable foundation of truths to build on. Both become vulnerable if there is no such foundation to be had – a more recent thought whose implications will occupy Chapter 4.

REASON IN SEARCH OF HIDDEN ORDER

Bacon's first way 'flies from the senses and particulars' and searches for 'the most general axioms'. This may seem perverse. Why not start in the obvious place, with perception and the experience of particular things given by the senses? The broadest answer is that the first way set out to reveal secrets of the natural order which lay beyond all powers of human observation. The scientific revolution brought with it a new vision of nature as a system of mass in motion driven by mechanical forces and governed by eternal laws. Sir Isaac Newton could see apples fall but he could not observe the force of gravity which he claimed to identify as the cause of their falling. Descartes claimed that space conforms to the analytical geometry now called Cartesian in his honour. He denied, however, that we know space to have these mathematical properties by sense experience. Instead, we know it because rational intuition guarantees the truth of some basic

axioms and whatever they entail. That calls for a theory of knowledge where the mind need not rely solely on the senses, since it could not grasp the realities of the natural order if it did. This remains one way for anyone who believes in unobservable forces and structures to justify their claim to know of them. To bring it alive, let us start with the new vision of nature at large, before turning to social or psychological structures and forces.

In a popular seventeenth-century image the world is like a watch. We tell the time by observing the face and hands but that gives no clue to how it works. To discover why the hands go round, we must prise the back off the watch and study the springs and wheels. The springs harness forces to drive the wheels which drive the hands in their turn. In this analogy, our five senses are confined to the face of the watch and observation can do no more than describe the movements of the hands. The springs and wheels are hidden from the senses and we need another way of knowing, if we are to learn about them.

This image turns up in, among other places, *The Plurality of Worlds* (1686), a delightful book by Bernard de Fontenelle (1657–1757) written to introduce general readers to those parts of the new astronomy which were 'most Probable, Uniform and Diverting'. Astronomy was chosen partly because it was the source of amazing discoveries and partly because it lent itself to novel mathematical ideas, like Descartes' analytical geometry, and so illustrated the new philosophy. (The seventeenth century drew no distinction between philosophy and science.) De Fontenelle fervently admired Descartes and the book sets out to show the merits of Cartesian ideas. It takes the form of a dialogue, spread over five evenings, between a Philosopher and a Countess who seeks enlightenment. The passages which follow are from the 'First Evening' in John Glanvill's enchanting (1688) translation. They start with another popular analogy for scientific enquiry at the time, that of going behind the scenes at the opera to discover how the special effects are worked.

The Philosopher has just remarked that 'your true Philosopher will not believe what he doth see and is always conjecturing at what he doth not, which is a Life I think not much to be envied'. He continues:

> Upon this I fancy to myself that Nature very much resembleth an Opera, where you stand, you do not see the Stage as really it is; but it is plac'd with advantage, and all the Wheels and Movements are hid, to make the Representation the more agreeable. Nor do you trouble yourself how, or by what means the Machines are moved, though certainly an Engineer in the Pit is affected with what doth not touch you; he is pleas'd with the motion, and is demonstrating to himself on what it depends, and how it comes to pass. This Engineer then is like a Philosopher, though the difficulty is greater on the Philosopher's part, the Machines of the Theatre being nothing so curious as those of Nature, which disposeth her Wheels and Springs so out of sight, that we have been long a-guessing at the movement of the Universe.

The comparison with an opera was topical, because a new and splendid opera house had just been built at Versailles and was famed for its ingenuity backstage. This prompts the Philosopher to picture 'the Old Sages' sitting in the audience and trying to explain the mechanics of a scene where Phaeton, mounted in a chariot, is lifted high in the air by the winds. The Old Sages have various explanations. Some say that he is drawn up by 'a hidden Magnetick Vertue', others that he has 'a secret love for the top of the theatre' and a hundred such extravagant fancies. 'But then comes Monsieur Descartes with some of the moderns', who reveal that Phaeton rises on wires with the aid of a hidden counterweight. Hence 'whoever will see Nature as really she is must stand behind the Scenes at the Opera'.

> I perceive, said the Countess, Philosophy is now become very Mechanical.
>
> So mechanical, said I, that I fear we shall quickly be asham'd of it; they will have the World to be in great, what a Watch is in little; which is very regular, and depends only upon the just disposing of the several parts of the movement. But pray tell me, Madam, had you not formerly a more sublime Idea of the Universe? Do you not think you did then honour it more than it deserv'd? For most have the less esteem of it since they have pretended to know it.
>
> I am not of their opinion, said she, I value it more since I know it resembles a Watch, and the whole order of Nature the more plain and easy it is, to me it appears the more admirable.

These exchanges mark a definite break between an older scientific scheme which dealt in, for instance, 'Magnetic Vertues' and a

modern one which 'has become very mechanical'. A key difference is that 'Vertue' involves ideas of purpose, meaning and proper function which belong to an older cosmology where everything had a part to play in the moral order of the cosmos. This is the blend of Aristotelian and Christian teaching which the scientific revolution was in process of destroying. Accordingly to become 'very mechanical' was to dispense with all but causal order, at any rate for purposes of science, so that scientific explanation could be cast wholly in terms of causes, effects and objective laws of nature connecting them. In particular the new scientific method required no direct reference to God's purpose in explaining how one state of the natural world leads to another.

This radical shift did not emerge all at once. Descartes himself maintained that an atheist could not be a successful scientist, because scientific knowledge depended on understanding nature as the creation of a God who decreed the kind of order displayed in it. The image of the watch is nicely poised between old and new. The movement of the hands is caused by the mechanism hidden behind the face and can be explained by prising the back off and tracing the wheels and springs. That is indeed 'very mechanical'. But the explanation is curiously blind if it fails to include the fact that a watch is intended to tell the time. The Countess finds the new order of nature 'the more admirable' because it shows how very elegantly the machinery of nature serves its purpose. A watch works by 'efficient causes' so as to serve its 'final cause', the purpose for which the watchmaker made it. This duality made for peace between the new science and religion and remained part of scientific thinking for at least another century.

All the same the decisive break had been made. The more detailed and complete the explanation of how a machine works, the less it matters why it exists. Each state of a perfect clockwork is the effect of the previous state and the cause of the next, given causal laws of its operation which can be formulated without mentioning purposes. If nature is a perfect clockwork then it runs forever in this utterly predetermined way and science can forget that God no doubt created it and wound it up in the beginning. It is as if God had said 'I declare this

universe open' and then left it to itself. Questions of why the world exists increasingly became separate from questions of how it works, until atheists were no longer at an intellectual disadvantage in science.

Bacon's first way is thus a search for universal laws which hold with necessity. The vision is strongly determinist, with Reason set the task of reproducing an order of things where each event *must* occur as it does, given its cause and the inexorable laws of nature. A sharp challenge to belief in human free will is looming. Descartes himself hoped to avoid it by treating the mind or soul as an immaterial substance separate from the material world and so not governed by natural laws. The human body behaves mechanically; the mind remains free. But this famous dualism of mind and body was always precarious. Even if philosophically defensible, it is threatened as soon as the methods of natural science are turned on human nature. If 'man is not fashioned out of a more precious clay' and the social sciences are to be guided by the principle that 'the general laws dictating the phenomena of the universe are necessary and constant', the challenge is unmistakable. Yet, as hinted in the last chapter, it may be possible to reconcile freedom with determinism. For the moment let us postpone the challenge, and go deeper into the idea of science as discovery of structure hidden behind the scenes, prompted because 'your true Philosopher will not believe what he doth see'.

APPEARANCE AND REALITY

In saying that 'Nature . . . disposeth her Wheels and Springs so out of sight', de Fontenelle did not mean merely that we need telescopes and microscopes to see them. He was invoking an ancient distinction between appearance and reality. Whatever our five senses tell us is classed as 'phenomena' (from the Greek word for 'appearances') and, in Descartes' version, phenomena belong in the mind of the observer. 'Reality', by contrast, refers to whatever in the universe itself causes the phenomena. Thus, when we report seeing a red rose, we are reporting an effect in our consciousness brought about by a

particular wavelength of light (or, in a rival theory, arrangement of corpuscules). The effect may vary in different observers and could be very different in animals. Descartes held that objects in nature have the properties identified in mathematical physics, properties like shape, number, mass and motion, whereas the data supplied by the senses have properties dependent on the mind aware of them, like the perceived colour or smell of the rose.

Whether this distinction can be coherently fleshed out is a vexed question in the philosophy of perception. But it is a familiar way of talking and leads readily to thinking in terms of two worlds, one 'inner', mental and somehow private to the perceiver, the other 'outer', physical and independent of the perceiver. Descartes certainly writes in this way, clearly regarding the new science of optics as a source of discoveries about the process by which objects in nature cause our perceptions. The reason that your true Philosopher will not believe what he doth see is that your true Philosopher comes to regard the data of sight as distinct from what causes them. This dualism of two worlds sounds, in general, very helpful to anyone who wants to speak of unobservable forces and structures, as many scientists do. The world as it appears to us is the effect of a distinct reality, allegedly furnished as theory claims.

But there is an obvious snag, as soon as we ask how we can know of these unobservable structures and forces. If observation were our only way of knowing about the world, as empiricists maintain, the snag would be decisive. But Descartes, like many rationalists who have taken Bacon's first way, held that we have a second faculty which gives an access to reality denied to the senses. He called it 'intellectual intuition' and cited mathematics, especially geometry, as a leading example of its use. Euclidean geometry rests on five axioms, from which it derives all its theorems with the help of logic. The resulting system, in Descartes' view, is a linked set of truths about the properties of space and serves as a model of how we can know more about the universe than the senses could possibly tell us.

In his *Discourse on the Method* (1637, Part II), Descartes made this ambitious claim:

> These long chains of perfectly simple and easy reasonings by means of which geometers are accustomed to carry out their most difficult demonstrations had led me to fancy that everything that can fall under human knowledge forms a similar sequence, and that so long as we avoid accepting as true what is not so, and always preserve the right order for deduction of one thing from another, there can be nothing too remote to be reached in the end, or too well hidden to be discovered.

I cannot resist adding de Fontenelle's more playful version:

> Madam, said I, since we are in the humour of mixing amorous follies with our most serious Discourses, I must tell you that in Love and the Mathematics People reason alike. Allow never so little to a Lover, yet presently you must grant him more, nay more and more, which will at last go a great way. In like manner, grant but a Mathematician one little Principle, he immediately draws a consequence from it, to which you must necessarily assent; and from this consequence another, till he leads you so far (whether you will or no) that you have much ado to believe him.

Cartesian scientific method thus relied on logical deduction to get from axioms to theorems. But deduction could not do all the work. To prove that a theorem follows is not to prove the theorem true, unless one already knows that the premises of the proof are true. How, then, do we know that Euclid's axioms, along with the basic principles of logic and mathematics, are indeed true? Descartes held that we know it by a mental faculty of intuition, which leads us to 'see' that the axioms of Euclidean geometry capture the essential properties of space. Similarly, intuition told him that he was a *res cogitans*, a thing which thinks, and guaranteed the truth of his famous *cogito ergo sum*.

Bacon elsewhere described rationalists who took his first way and tried to make mathematics the model for all knowledge as 'men of dogmas', adding that they 'resemble spiders, who make cobwebs out of their own substance'. Certainly the method seems suspect on several counts. Take Euclidean geometry, whose axioms Descartes held to be definitive. Since his time, Riemann and Lobachevsky have proposed rival geometries with alternatives to Euclid's fifth axiom (which says, roughly, that parallel lines never meet). If they are coherent, and if, as has also been claimed, space conforms to either of them, rather than to Euclid, Descartes'

'intuition' misled him. More generally, where there is more than one internally coherent system, coherence ceases to be a guarantee of how the world is. Suspicion soon falls on the very idea of intuition as a faculty of mind which sheds the light of Reason on a reality underlying appearances. It then seems that Bacon's first way indeed relies on dogmas which give rise to cobwebs spun from subjective assumptions masquerading as intuitions.

'MIDDLE AXIOMS'

Although the first way is now largely out of fashion, it was never foolish and it still haunts the philosophy of science. This is not because ghosts, once acquired, are hard to shed. The philosophy of nature remains 'very mechanical' and inclined to believe in a hidden order of unobservables beyond the reach of our five senses. As soon as science tries to deal in unobservables, it has to be able to justify such claims. If, strictly speaking, we cannot observe electrons, social institutions or the unconscious mind, then why believe claims that they exist? If explanations are offered in terms of magnetic attraction, market forces or psychic processes like Freudian repression, what warrants such causal claims? The rationalist answer was to introduce 'middle axioms' and it remains instructive, not least in making us see that it is idle to propose an ontology and explanatory method, unless one also tackles the resulting problem of knowledge.

Descartes hoped that the method which yielded the 'first knowledge' could encompass the whole of philosophy or science and lead to a single, integrated account of a single, integrated natural order. As he declared in *The Principles of Philosophy* (1644):

> the whole of philosophy is like a tree, whose roots are metaphysics, whose trunk is physics and whose branches are the other sciences, which can be reduced to three principal ones, namely medicine, mechanics and morals.

Middle axioms are the nodes on the tree, the points of departure for particular sciences and then for sub-branches. Thus, having established a potent mathematical physics (the trunk), we are to identify the essential properties of human nature which make for a general science of 'morals', and then subdivide that branch into axiomatic theories of economics, politics and so on. The whole tree will consist of theories which match the natural order and which we know to be true because we have derived them from the self-evident first knowledge with the aid of middle axioms.

This is visionary stuff and alarmingly speculative, except perhaps for mathematical physics and mechanics. There, in seventeenth-century spirit, one can readily envisage real but unobservable particulars, like electrons, or forces, like gravity, and can even suppose that organised theoretical intuition gives knowledge of them. For the social sciences, however, a rationalist approach is far less perspicuous. Consider the proposition that economic behaviour is governed by market forces and the laws of supply and demand. To render it scientific, one will need a basic ontology, for instance the forces and relations of production referred to in Marx's Preface, and a methodology which lets dependent variables, like rates of profit, be explained as effects of the productive forces and relations in particular conditions. When asked how one knows all this, one will reply by laying out an economic theory which makes sense of states of the economy and add that it rests on true middle axioms introducing the basic economic concepts. When asked how one knows that the middle axioms are true, one will reply either that they are self-evident or that, although they are axioms for economics, they can be derived as theorems from more general axioms further down the tree.

Stated so bluntly, this all sounds very dogmatic. That is partly, no doubt, because it does not even hint at the complexity and sophistication achieved by Marxist economic theories. Also it is misleading, if it suggests that rationalism favours Marxist theories over others. As to that, however, neo-Classical microeconomics too can be envisaged as an axiomatic theory which sets out to capture the essence of economic behaviour by defining it as rationally self-interested choice by individuals, and then goes on to derive a crop of theorems. In some versions, moreover, the theorems purport to extend into macroeconomics, thus promising a general theory ambitious enough to please any rationalist. But, however sophisticated the analysis, critics are still likely to jib at

the whole idea of transcending the limits of observation by theoretical reflection and then claiming that such reflection carries with it knowledge of reality. Indeed, the very fact that rival economic theories can be given similar axiomatic treatment seems to debar a claim to knowledge on behalf of one of them, while another is in the field. Theorists who argue that their favoured theory is true on the grounds that it is coherent do indeed sound much like spiders who make cobwebs out of their own substance.

NECESSITY

Yet rationalism offers a solution to some awkward puzzles about necessity and at least serves to show why necessity is problematic. Why exactly does economics, or any other science, need a theory? Why can it not be content to observe the world and generalise what it observes? Rationalism gives two answers, both connected with the thought that, in the words of an old apothegm, 'the senses reveal no necessities'.

One is that theory is needed because science is a search for causes, whereas observation cannot get beyond mere correlations. When a bomb explodes, it does so because energy is suddenly released by the unbalancing of a set of forces. When prices rise, they are responding to the pressure of market forces, governed by the laws of supply and demand. To explain an event is to identify its cause, thus placing it in a series of events each of which gives rise to the next. The series is not a mere sequence but one connected by the powers of the particulars involved to produce the next state in conformity with the laws of nature. To think causally is to think in terms of powerful particulars and compelling laws. The Countess had both ideas in mind when noting that 'Philosophy is now become very mechanical' and that the universe 'resembles a Watch'.

Causes are thus being ascribed some kind of necessity. When the bough breaks, the cradle *must* fall; when prices rise and other things are equal, demand *must* fall. When science turns 'very mechanical', these 'musts' are not idle. We observe only that the cradle does fall but we explain the event by showing why it had to. If the senses reveal no necessities, what does? Here seventeenth-century rationalists made what looks like a mistake. They were deeply impressed by the luminous qualities of mathematics, which they regarded as a model for all scientific knowledge, in the spirit of Descartes' comment about 'these long chains of perfectly simple and easy reasonings'. Mathematical truths have the interesting feature that they not only *are* true but *could not possibly* be false. A mathematical proof proves that a set of axioms (A) entails a theorem (T) in the sense that it yields a statement, which can be summarised as

$$\textit{Necessarily}\ (A \rightarrow T)$$

Granted that the axioms are necessarily true, which we know by intuition, the proof demonstrates that T is necessarily true too. Since intuition and proof are methods of discovering that T is true, as opposed to conferring truth on T, theory can give us knowledge of necessities.

The other reason why we need theory stems from this view of logic and mathematics as a voyage of discovery into an eternal realm of numbers and relations. Facts about numbers are objective and necessary facts of a universe which, at least in these ways, could not be otherwise. The truths of mathematics are, in a seventeenth-century phrase, 'true in all possible worlds'. Pigs might fly but triangles whose sides are in the proportions 3:4:5 *must* be right-angled. Since geometry, in Descartes' view, reveals the essential properties of space, it provides an ideal model for identifying ways in which the world must be as it is. Equally, if it is true that bodies attract one another in inverse proportion to the square of their distance apart, then this too is necessarily true, and explanations which invoke this fact will be able to show why collisions must occur at the velocities involved in them.

The two answers, taken together, thus identify the puzzling necessity attaching to causal connections with the luminous necessities of logic and mathematics. That certainly sounds like a mistake. Philosophers today do not equate the force of a bullet, propelled by the force of exploding gunpowder, with the 'force' of a mathematical deduction which prevents one reaching any con-

clusion but the one entailed. If there is a real necessity in causal powers and mechanisms, it calls for a different sort of elucidation. In general necessities of thought, ideas or language (*de dicto*) are not to be confused with those of natural properties, powers and processes (*de re*).

That sounds only sensible, and I shall not labour the rationalist case for denying it. But, in distinguishing necessity *de dicto* from necessity *de re*, we are setting puzzles about both. The social sciences are rich in pure theories, which resemble mathematics in starting from axioms or postulates and deducing theorems from them. The most elaborate examples are in economics but there are plenty of others, for instance those of coalitions in politics, of power in sociology, of kinship in anthropology or of grammatical transformation in linguistics. Also the use of statistics involves abstract, highly structured theories involving logical deductions. We need to be clear about the purpose of such theoretical activity. Perhaps it serves only to organise empirical material, as will be suggested in the next chapter. But, even so, there is still a question of what guarantees the logical relations involved. Rationalism maintains that there are immutable laws of thought, whose necessity cannot be proved because all proof presupposes them. Whether there are any such laws will not concern us directly until the chapter on rationality and relativism, but is worth pondering in the interim.

Meanwhile, abstract theories of, for instance, rational choice, power or language look as if they were intended to offer definitive, if abstract, accounts of their subject. That is how rationalism would regard them. It is plainly contentious to hold that the purpose of a theory of, say, power is to isolate the essence of power by defining the concept of power in the way which captures that essence. On the other hand, if this is not the purpose, then what is?

Necessity *de re* is no less puzzling. In what sense, if any, *must* the cradle fall, when the bough breaks? The question recalls an obvious difficulty about Marx's Preface. Its philosophy was, as the Countess would say, 'very Mechanical', being couched in a language of hidden forces and mechanisms. Even if we think we grasp the idea of causation here and the relation envisaged between causes and their effects, there is still a palpable epistemological problem of how we can know that reality is a system of forces, hidden from our everyday ways of knowing by experience. If we reject the rationalist equation between logical necessity and causal necessity but want to remain realists about social structures and forces, we shall need a suitable account of causation. This will be made harder in the next chapter, when empiricism has sharpened the objections to dealing in such unobservables.

CONCLUSION

Bacon's 'first way' remains influential as well as instructive. The seventeenth-century vision of nature as an integrated system, a complete causal order veiled from the senses, has not died out. Nor has the hope of a unified system of scientific knowledge. But both have become more remote and speculative as science advances, for reasons which will serve to summarise the chapter.

The rationalist *ontology* of 'Wheels and Springs', of structures and forces operating with necessity, has become even more metaphorical. Progress reveals new areas of ignorance, as well as of knowledge. Today's scientists have different, more tentative, inventories of the ultimate furniture of the universe. Work on the human genome, for instance, cannot be conducted in seventeenth-century categories. Nor is there the old confidence that a complete causal determinism holds throughout an integrated natural order. On the other hand, since Descartes set the roots of his tree in metaphysics and we are not directly concerned with the ontology of the natural sciences, metaphors may suffice. The relevant point is that rationalism gave the human sciences a strong invitation to search for hidden structures and forces. Whether psychological or social, they would turn out to be the determinants of human behaviour. Acceptance of the metaphors of a philosophy 'now become very Mechanical', as the Countess put it, has had powerful effects on ideas of explanation in the social sciences, as we shall find in Chapter 5.

Rationalist *methodology* was disposed to assimilate the 'necessity' with which a cause generates its effect to the 'necessity' which distinguishes a causal law from a mere correlation, and then to

assimilate both to the 'necessity' which marks the truths of logic and mathematics. This plainly sets more questions than it begins to answer. Here are two which will need tackling, if we are to reach a coherent view of the proper tasks of theory in the social sciences. Firstly, theories include 'long chains of perfectly simple and easy reasonings' like those 'by means of which geometers are accustomed to carry out their most difficult demonstrations'. So is one of their tasks to establish theoretical truths which are necessarily true of a realm defined by 'middle axioms'? If not, what warrantable purpose do theoretical abstractions serve? Secondly, if there are 'natural necessities' and they are *de re* rather than *de dicto*, what account of causation should we favour?

Rationalist ambitions were much helped by a distinction between appearance and reality, which relegated sense experience to an effect of external causes. That let theory, certified by 'intuition', trump observation in the search for order in nature. Even if we are wary of such a distinction, we cannot refuse the questions thus raised about the relation of theory to experience. A neat answer would be that observation in fact always trumps theory. But, as the next two chapters will show, the truth is not so neat.

Epistemologically, a manifest problem of knowledge has been posed. Do we really have a faculty of reflective reason, which lets us know what the senses cannot possibly tell us? If not, we shall need another way to justify some claims to knowledge, which extends beyond the immediate reach of the senses to what has not been observed and perhaps to what is unobservable. A still deeper epistemological problem is set if we also reject the rationalist assumption that science casts the light of Reason on a world existing independently of human exploration. The image is hard to resist, not least because it makes the external world the test of whether we have the correct concepts, theories and hypotheses. But it presupposes the standpoint of the Engineer in the Pit who can 'see the Stage as really it is'. What follows, if there is no such standpoint to be had, will be considered in Chapter 4.

Finally, it is worth noting some signs that a philosophy of science geared to the natural sciences may cause peculiar trouble for the social sciences. A warning was given by Descartes' assurance that human freedom is not threatened by modern science, because the human mind is not subject to the laws of nature. In that case, however, psychology and other human sciences seem either impossible from the start or certain to destroy our illusions of free will and moral responsibility. When we unpick this dilemma, we still have to think twice about Descartes' insistence that 'there is nothing easier for me to know than my own mind' (closing paragraph of the Second Meditation). One implication of his *Cogito* is that self-knowledge is a sure foundation for all other knowledge. Granting for the moment that there is or even can be any sure foundation at all, the social sciences might be especially tempted by self-knowledge which casts light on action from within. But they cannot allow that the actors are always the best authority on themselves and their actions. Yet a stubborn element of self-reference will obtrude when we consider the difference between Understanding and Explanation.

But we are not yet ready to question a naturalism which maintains that 'Nature has used only one and the same dough' and that a single scientific method will suffice. To start us on Bacon's second way here is an overarching question for all science. It comes from J. S. Mill's *A System of Logic* and is very much a rationalist question except that his 'uniformities' do not indicate hidden necessities:

> What are the fewest and simplest assumptions, which being granted, the whole existing order of nature would result? . . . What are the fewest general propositions from which all the uniformities which exist in the universe might be deductively inferred? (1843, Book III, Chapter 4)

In search of an answer, let us turn to the senses and particulars.