CHAPTER VII

FACT, CONSTRUCTION, AND HYPOTHESIS

IN our last chapter we took for granted that the solitary mind somehow attains to knowledge of the existence of other minds, and we undertook to explain later how this came about. To do so will be our next constructive task. But before attempting to carry it out, I wish to consider briefly some important corollaries of the conclusions which we reached in the last chapter. These corollaries refer to the part played in the development of knowledge by fact, construction, and hypothesis. It will be convenient to introduce the question of what place fact holds in our theory by considering a possible objection which might well be made at this stage to the argument of the last chapter.

I can imagine our critic wording his objection somewhat as follows: 'The building up by minds of a public external world', he might say, 'depends for its possibility upon the fact that the experiences of the different selves run parallel to one another in certain definite ways. There is between the courses of the various private worlds a parallelism which was pictorially brought out by comparing them to duplications of the same cinema film. It is this parallelism which renders the construction of the external world possible. If it did not exist, there could be no contact between the many minds, and each would remain for ever shut up within its world of private phantasms.

'Now this remarkable parallelism is simply taken for granted by the theory. It is wholly unexplained. As it stands in the theory it is simply a miracle. In order to explain it, shall we not be compelled to introduce either the disreputable and discredited theory of a pre-established harmony or some modern equivalent?

'For if we suppose that there is to start with no common world, but only a vast multitude of private worlds disconnected and independent of one another, is it not infinitely

improbable that such a parallelism between them all should exist? Should we not rather expect each world to run its own course in its own sweet way, to be different from all the others, so that no common world could ever arise?

'This difficulty is created by the present theory, but does not exist for the theory of common sense realism. That view holds that the common world is not constructed by mind but is there already before mind comes upon the scene. The many minds come to it and find it. It is therefore natural on this theory that, as the many minds perceive the same world, their experiences should run parallel.'

Now it is quite true that our whole theory depends on the assertion of the parallelism, and that this parallelism is itself entirely unexplained by it. It is not, however, 'taken for granted' in the sense that it is assumed without proof. For the proof of its truth lies in experience. It is a *fact* that my world and yours agree in certain respects. It is found in experience that when *A* and *B* compare notes as to what they perceive, although they cannot prove the identity of the matter of their percepts, they can communicate with each other *as if* they were the same. This possibility of communication proves at least the similarity of the internal relations of *A*'s world with those of *B*'s world. It proves that, so far as the parallelism extends, there is a point to point correspondence of relations. This is the only parallelism on which our theory relies. No one disputes the existence of this parallelism, least of all the realist. For if he disputed it he would have to hold that the private experiences of the common world which arise in the many different minds are all different from one another, which would be equivalent to denying the existence of a common world altogether. This, it is evident, would destroy the possibility of realism or indeed of any theory whatever. It would reduce the universe to chaos. Hence the parallelism is a fact which is, and must be, admitted by all intelligible theories.

We cannot be criticized, then, simply on the ground

that we assert this fact. For all theories equally assert it. Nor can the charge against us be that we assert it without proof. For it is as certainly based upon empirical evidence as any other fact whatever. The gravamen of the accusation against us must be, I think, that we have not *explained* this fact. And it is assumed by our imaginary critic that common sense realism does explain it.

It is true that I have not explained it. I do not intend to do so. And I assert that there is not the slightest reason why I should. It is no part of the purpose of this book to explain ultimate facts. The purpose of this book may be roughly described as follows. We have sought, firstly, to ascertain what are the ultimate facts and certitudes which are presented to consciousness; and secondly, how the mind logically passes from these its ultimate premisses to the rest of its knowledge. Prominent among these ultimate facts, for example, are our immediate sense-data.

It is no part of the business of our investigation to try to get behind the ultimate facts, or to explain them. I do not profess to be able to explain, for example, why a red patch is now appearing to me. I admit that I cannot explain it. And I think it probable that no one can explain it. It is an ultimate brute fact.

The spirit of our inquiry is entirely empirical. Our philosophy is an empirical philosophy. The astronomer observes the characters and the movements of the heavenly bodies. These are his facts, on which he builds his scheme of astronomical knowledge. He may seek to trace out the history of the stars, to show how they began in nebulae, and how they arrived at their present state. But he makes no metaphysical or ontological inquiries into *why* all these facts are what they are. For epistemology the colour patches, sounds, and odours, and the existence of myself perceiving them, are ultimate facts. We seek to show how knowledge has built these up into a common world. We seek to base upon them a theory of knowledge. To explain *why* the facts are what they are is no part of our undertaking.

Attempts to explain the ultimate facts of consciousness

have, of course, been made. Fichte accounted for our sense-data as being due to the self-limitation of the ego. Others have sought to explain the existence of the world (i.e. of the sum total of external facts) by transcendental theories of the Absolute, or by Platonic Ideas, or by theism, or by teleology. Whether these attempts could ever succeed, whether, for example, it could ever be shown that red is red because it is in accordance with the Idea of the Good that it should be so—on these questions I am not at present disposed to express any opinion. I shall say only that such attempts to reach beyond and behind experience into the metempirical reason of the universe are foreign to the empirical spirit of this inquiry and lie entirely outside its scope.

Now the parallelism which exists between the many private worlds is an ultimate fact. It is true that it is not one of the ultimate certitudes of the solitary mind. It is not an element of the given of any one mind. It cannot be, since it involves the comparison of the experiences of at least two minds. But it is nevertheless a *fact* as distinguished from a mental construction. It is a fact which, though not known directly and immediately by any one mind, is *inferred* by each mind from what it observes. As we shall see in the next chapter, the existence of other minds is an inference which each of us draws from his own private experiences. Having made this inference we find that intelligible communication is possible. And we then draw from this possibility of communication the further inference that there exists such a parallelism as has been described. Hence the only difference between the facts of our immediate sense-data and the fact of parallelism is that the former are directly known facts while the latter is inferred. This difference in no way invalidates our assertion that the parallelism is a brute fact. However we come to know it, whether directly or by inference, it is still an ultimate fact which has to be simply accepted and cannot be explained.

Nor is there any truth in the suggestion that, although our theory cannot explain parallelism, the theory of

realism can. When two minds *A* and *B* simultaneously look at a penny, the facts then are, according to our theory, that there exist two corresponding but not provably similar experiences which *A* and *B* agree (because they correspond) to call a brown patch, and that they together construct out of these experiences a common penny. According to the realist the facts are that there actually exists a single common penny, which is not constructed but is 'there'. But the realist can no more explain his alleged facts than we can explain ours. He can no more explain why there exists one common penny than I can explain why there exist two private but corresponding pennies. There is no reason for alleging that two parallel private pennies are any more mysterious, any more miraculous, or any more difficult to explain, than a single common penny.

Not only this. But the realist's account of the matter raises difficulties which are avoided by our theory. For the realist thinks that *A* and *B* both look at the *same* penny. But this is contradicted by the fact that what *A* sees is a round dull patch, while what *B* sees is an elliptical shiny one. To get out of this difficulty the realist is compelled to resort to all kinds of desperate shifts. He may assume that behind the presentations there exists a common 'thing' and that this 'thing' is not a construction but is 'really there'. If so, he soon finds that this conception is self-contradictory. It lands him in a quagmire of contradictions, some of which were noted in the last chapter, and all of which can be studied at length, if the reader is so disposed, in Professor Lovejoy's book *The Revolt against Dualism*. Our theory avoids all these difficulties by denying that the common penny is anything more than a mental construction, and by pointing out that contradictions may well exist in makeshift ideas which the mind invents for its own purposes. These contradictions were not apparent to it at the time when the constructions were made, i.e. at the dawn of the mind's history, and have only been brought to light by the investigations of philosophers. This seems a reasonable way of explaining these contradictions.

But the realist is committed either to attributing them to the facts themselves or to making various futile attempts to explain them away as not being really contradictions. Our view admits the contradictions, but simply attributes them to the fallibility of human ideas. In this our theory has the advantage over realism. Neither explains the facts. But realism, besides not explaining them, makes them self-contradictory.

We are all of us, realists and ourselves, in the same boat as regards explanation of facts. All facts are ultimately mysterious, inexplicable, even miraculous if you like. But they are all equally so. It is just as miraculous that there should be one brown patch as that there should be two or a million. If there is a parallelism between private worlds, this is no doubt inexplicable. But it would be equally inexplicable if all the worlds differed. Any brute fact, just because it is a brute fact, has simply to be accepted and cannot be explained. If it seems surprising to the mind that private worlds should correspond, this surprise is merely an emotional attitude which has no logical foundation.

For how is the fact that whenever I see a red disk you also see a red disk more wonderful or more surprising than the fact that whenever there is rain there are clouds, or than any other instance of causality, or of orderliness and harmonious working in nature? And if it is accounted sufficient to accept the uniformity and orderliness of nature as an ultimate fact which we cannot explain, why should it not be sufficient to accept the uniformity and harmony of the experiences of different minds as an ultimate fact which we cannot explain?

The parallelism of the private worlds is simply one instance of the ordered character of the universe. But because the thought of a multitude of independent worlds running parallel is an unfamiliar example of the general orderliness of nature, it perhaps appears more surprising to the reader than the familiar examples of causation and the common and well-known uniformities of nature. This attitude is understandable but not rational.

The universe is a cosmos, not a chaos. The cosmotic character of the universe has been explained by theories of theism, teleology, transcendental realms of rational forms, pre-established harmonies, and the like. With none of these theories are we concerned in this book. And the epistemologist who starts from the undoubted fact of parallel private worlds has just as much right to decline to attempt an explanation of this as the astronomer or the physicist has to decline to attempt an explanation of the law of causation on which the whole of his science rests.

We supposed our imaginary critic to inquire whether it was not infinitely improbable that, if the many private worlds are disconnected, they should yet run parallel. Perhaps it is, I reply, just as it appears infinitely improbable that a world ruled by blind chance should be an orderly and harmonious cosmos and not a chaos of colliding atoms. For all I know the fact that the world is harmonious and orderly may be a good argument for theism, teleology, or some similar theory. And for all I know the fact of the parallel worlds may constitute a new string in the theist's or teleologist's bow. For it is certainly part and parcel of the general orderliness of the world. It has made possible the construction of a common cosmos which may perhaps have been intended by the divine mind. But these are not the questions which I have undertaken to discuss. It is sufficient for my purposes that the parallelism is not more improbable than the law of causation or any other example of order in the world, and is in any case an undisputable fact on which I am entitled to build. I am asking for no further latitude than is granted to any science in the world, namely to build its theories on the facts, however surprising or unaccountable those facts may appear.

This discussion will have thrown some light, I think, both upon our conception of the nature of fact and upon its place in epistemological theory. But the nature of fact will be made clearer if it is contrasted with the nature of construction. And I will now proceed to some general

remarks about the constructions which have already come before us in the last chapter.

The six constructions of the last chapter fall into two groups. I shall call these respectively (1) unificatory constructions, and (2) existential constructions.

(1) *Unificatory Constructions.*

The second, third, and sixth constructions of the last chapter fall into this group. Their common character is, not that they postulate any new existence, but that, on the contrary, they reduce the number of existences in the universe by identifying as the 'same' certain objects of consciousness which were originally 'different'. The second construction identifies my red with your red, my world with your world, and in general the private worlds of all minds with one another. It reduces the multitudes of *simultaneous* worlds to one. The third construction identifies my red at this moment with your red at a later moment. It begins the reduction of the many *successive* worlds to one. The sixth construction identifies and declares to be the 'same' the originally different objects of the different senses. It reduces the several worlds of sight, hearing, touch, &c., to one world.

Unificatory constructions rest upon the logical principle that superfluous existences, that is, existences which make no difference of any kind either to knowledge or to our practical activities, may be ignored and treated *as if* they were non-existent. As they are irrelevant to the mind's purposes, whether theoretical or practical, they may be cut out of the universe altogether.

The other chief logical character of unificatory constructions is that they cannot be proved, are not *facts*, but are simply serviceable fictions. They are not inferences from facts. One unificatory construction may indeed be an inference from another construction. Thus the third construction is an inference from the second. Or at least the second construction is *one* of its premisses. The second construction declares that *A*'s red is identical with *B*'s red seen simultaneously. But *B*'s red seen a second

later is identical with the red he saw during the first second. From these two premisses it follows that the red which *A* sees during the first second is identical with the red which *B* sees during the following second (when *A* sees none). This gives us the third construction. In this way constructions may be connected *inter se* by the relation of implication. And when they do so they form systems of constructions. But they are never inferred from facts or perceptions. If they were they would cease to be constructions and become facts. If a system of two or more constructions is such that the particular constructions which are its members are mutually related to each other by implication, yet the whole system as a system is not inferred from anything, but is, on the contrary, assumed, created, or constructed by the mind.

(2) *Existential Constructions.*

The first, fourth, and fifth constructions belong to this group. Their common character is that in them the imagination invents the fiction of some new existence which is not given in, or inferred from, experience.

This new existence is conceived after the model of experienced existence, and is made in one way or another out of the materials of sense. Since it asserts an existence which is never actually experienced, it is always expressible only as an hypothetical proposition of the form 'If the circumstances were suitable, we should perceive the existence.' And the condition expressed in the antecedent clause is always an impossibility because by hypothesis we can never perceive, or be in a position to perceive, the new existence.

Since the mind is not compelled, either by the force of perceived fact or by the necessity of logical inference from perceived fact, to adopt constructed beliefs, the question why it does so must present itself. What makes the mind construct beliefs which are not implied or even suggested by the facts? What, in other words, are its motives? The answer to this question should be clear from the discussions of the last chapter, but may be summed up here as

follows. The motive which has guided the mind to the constructions so far made, whether unificatory or existential, has been either (1) simplification, or (2) consistency. This may be briefly verified by reference to the six constructions.

The first, second, fourth, and sixth constructions were made for the sake of simplification. In the first it was found simpler and more convenient to regard the corresponding presentations of different minds as similar rather than as dissimilar. Either view would equally suit the facts and would be equally 'true' and workable both in intellectual thought and in practical action. The simpler of the two views was chosen. In the second construction it was found simpler to regard corresponding presentations as identical and to believe in one universe rather than in many. In the fourth construction it proved to be a simplification to suppose that things go on existing when unperceived, and that the world is continuous in time, rather than that it goes out of existence when perception ceases and that a new universe begins to exist when perception begins again. The sixth construction simplifies the universe by reducing the several worlds of the different senses to one world.

The third and fifth constructions, on the other hand, have been made for the sake of consistency. The mind having invented its theory of a common world was brought up hard against inconvenient facts which contradicted this theory. These facts were the *differences* which exist between the private worlds of the various minds. The motive of these constructions was to reconcile these differences with the theory of the common world and so get rid of the inconsistency. In the second construction *A*'s red patch had been identified with *B*'s. But the fact that *B*'s patch goes on being perceived after *A*'s has ceased to be perceived is inconsistent with this, unless it is held that *A*'s patch may go on existing in *B*'s mind after it has ceased to be perceived by *A*. In order to be consistent the mind was forced to take that view, and the third construction resulted.

Again the theory of the common world was threatened with disaster by the discovery of a multitude of differences between the private worlds. Of these differences, that between the round and the elliptical penny may be taken as typical. At first sight they appear to be fatal to the belief in the common world. But rather than go back on its tracks and renounce its common world the mind, by means of a bold speculation, or rather by a bold invention, finds a way out. It creates the idea that there exists a self-identical 'thing' behind the differences. It holds, without contradiction, both to the differences and to the identity by placing the differences in the presentations and assigning the identity to the 'thing'. This is just as if one were to avoid the contradiction of holding that the same object is both black and white at the same time and on the same part of its surface by saying that it is black on one side and white on the other. This invention of the 'thing' for the sake of consistency is the fifth construction.

We find again and again in the history of knowledge repetitions of this procedure. The mind, having invented a construction for the purposes of simplification and convenience, meets with new facts which do not square with the constructed belief. It is forced either to retrace its steps, abandon the ground which it has gained, and give up the construction or even the system of constructions (which may well constitute a large block of its scheme of knowledge), or, in order to avoid this, it is compelled to manufacture new constructions or systems of constructions which will reintroduce harmony and avoid contradictions. In this way human knowledge grows as well as by the accumulation of new facts and inferences.

It results from our epistemological analysis that two wholly different kinds of existence must be recognized. They are respectively (1) *factual* existence, and (2) *constructive* existence.

Factual existence is the existence of whatever is, has been, or will be actually perceived by any mind at any time or place.

The existence of my desk while it is being perceived by me or by any one else is a factual existence. Or rather, to be more accurate, the existence of the visual appearance of the desk while it is being seen, the existence of the tactile sense-data of it while it is being touched, and so on, are factual. But in the night when no one is perceiving the desk, when it is only supposed by the mind to be there, its existence is a constructive existence. Even while it is being perceived, only what is actually perceived is factual. Thus while I am looking at it, but not touching it, its visual sense-data have factual existence, but its tactile sense-data have only constructive existence. And at all times, whether the desk is being perceived or not, the supposed 'thing', behind the presentations and different from them, has only constructive existence.

The sun rising to-morrow has a factual existence. It *will* be actually perceived. The existence of Julius Caesar is also factual. For it *was* actually perceived.

For the purposes of epistemology it is essential to make this distinction between factual and constructive existence. *But for the purposes of all other knowledge it is essential to obliterate and forget it.* The whole point of the construction of the desk's existence when no one is aware of it is that we should *suppose* that it goes on existing when unperceived *in exactly the same way* as it does when perceived. To suppose this is obviously precisely what the construction consists in. It applies the concept of factual existence to all existence whether perceived or not.

Or we may put this in another way. There is a distinction between factual and constructive existence. But this distinction is one which makes no difference of any kind either to theory (except the theory of epistemology) or practice. I may suppose if I like that this typewriter either is not here when I do not perceive it or that its existence is then of a different kind. But what it is or is not during inter-perceptual periods makes no difference to me as a practical person wanting to use it for writing my book. So long as it is there whenever I turn to it, what else matters? Nor does it make any difference to my

knowledge of it. The method of manufacture of typewriters, their mechanism, the metals of which they are made, the chemistry, metallurgy, and physics of these metals, any conceivable knowledge we might have of them, remains precisely the same whatever happens to them during inter-perceptual periods. It is, as we have seen, a logical rule of the mind that it ignores and treats as non-existent superfluous existences, existences which make no difference of any kind either to theory or practice. Therefore the existence of the distinction between factual and constructive existence is ignored. All existence is lumped together as factual, and this identification of the two kinds of existence may itself be regarded as a unificatory construction.

It is true that the distinction does make a difference to the theory of epistemology. But the human mind has not in the past regarded epistemology as of such paramount importance as to justify the distinction being retained as a part of ordinary knowledge. Epistemology may be left to look after itself. If and when its time comes, it can make the distinction for itself, as we have now done.

Moreover the attitude which the mind takes up in this matter must be regarded as 'true'. The greater part of our knowledge has been built up by mental constructions. If we are to admit this knowledge *as* knowledge, and not as falsehood, we must admit the constructed beliefs of which it is so largely composed as being truths. We must conceive that it is true that there is an independent external world, that things exist when no one is perceiving them, that the penny which you see is the same penny as the one I see, that the table which I touch is the very same table as the one I see. These propositions form a part of our admitted knowledge of the world. They are universally accepted as true. Unless we are to do extreme violence to all accepted standards of truth and to all acknowledged conceptions of knowledge, we must also admit them to be true, *and must frame our definition of truth so as to include them.*

These propositions belong to our common everyday

knowledge. If we consider what would generally be called scientific knowledge, as distinguished from common knowledge (though the distinction is, of course, a relative one) we shall reach a similar conclusion. Scientific knowledge, like common knowledge, is largely composed of mental constructions. This we shall see more clearly when we come to our chapter on scientific knowledge. For the present we shall only remind the reader that the so-called 'hypothetical' character of such knowledge is widely admitted at present even in scientific circles, and that, as has been pointed out, what is really meant by this 'hypothetical' character is that science is largely composed of constructions. If then we are to regard scientific knowledge as true, we must admit that truth includes constructions. The atomic theory of matter, not to mention the electronic theory, is a construction. But by saying this we do not mean that it is false. Its truth or falsity is not a matter on which the mere philosopher has any right to express an opinion. If its truth is guaranteed by competent scientific authority we shall accept that. And if it is true, then it will follow that a construction may be true. We have to take a broad view of knowledge, to regard it in something the same way as we regard the world of art. The world of art is a product of the immense labours of the human spirit. So is the world of knowledge. It has been constructed by countless minds working through countless centuries. And this great creation of thinking spirit is not to be dismissed as 'untrue' by philosophy, except at the peril of philosophy. And a philosophy which so concludes is not likely to live long.

Truth, therefore, must be held to include those constructions which have been once and for all built into the body of human knowledge and now form permanent parts of it. This, of course, will raise another problem. Constructions are fictions. And if *all* constructions are true, this will destroy the distinction between truth and falsehood altogether. For in that case any figment of a frenzied brain might claim to rank as truth. Evidently some constructions must be true, others false. And this

throws upon us the duty of distinguishing the nature of a true construction from the nature of a false one. We shall have to discover what are the conditions which render a construction valid and mark it off from invalid constructions. I shall attack this problem in due course, but I must beg leave to postpone it for the present. We have not advanced sufficiently far in our investigations to solve it. I shall return to it on a later page.[1]

We agree, then, that for all purposes both of practical action and theoretical knowledge it is true that objects exist unperceived, that unperceived existence is as much factual as perceived existence, and that there is no distinction between the natures of perceived and unperceived existence. To this statement there is only one exception, and that has to be made in the case of epistemology. As epistemologists we are bound to point out the distinction between factual and constructive existence. The growth of knowledge has long ago deliberately obliterated it. It was by turning the blind eye to this distinction that the great adventure of knowledge, the great creative work of the human spirit, began. And to forget and to deny this distinction must necessarily be a point of honour both with ordinary knowledge and with the sciences, for their being is bound up with such forgetting and denial. Only the philosopher, for his own eccentric purposes, which differ from those of other men, needs to remember here. Nor can it be said that there is any contradiction in this. For ordinary knowledge and for science there is no distinction. For philosophy there is a distinction. This may appear formally contradictory. But this after all means only that the distinction is of importance for the special purposes of philosophy, while it is of none for the purposes of science and ordinary knowledge, which may therefore ignore it and treat it as non-existent. And in this procedure there is no contradiction.

Hypotheses may assert either factual or constructive existences. Suppose I hear a scratching noise behind the

[1] In Chapter XV.

chest of drawers. I conjecture that this may be due to a rat. This is an hypothesis, the verification of which consists in seeing the rat when it is driven out with a stick from its hiding-place. The hypothesis asserts the factual existence of the rat. The rat, it is plain, is not a construction, but a fact.

It is true that the existence of the visual rat when it is not being seen is a construction, and it might be insisted, if we wish to be pedantically accurate, that when I say 'I believe that the noise is caused by a rat' this belief is not an hypothesis, but a construction. Most writers, however, would call it an hypothesis. And we can avoid a pedantic departure from common usage by means of the consideration that the belief really consists of two parts. Firstly, there is my general belief in an independent external world existing whether I perceive it or not. Secondly, there is my belief that among the objects in this independent world is a rat which is causing the noise. It is only the first of these two elements of my belief which is a construction, and that construction is no part of my present mental process in guessing at the rat, but was made long ago in the dawn of mind. If, granted the general belief in the independent external world, I now guess at a rat, this is certainly an hypothesis. I am not *now* constructing an unseen visual rat. The existence of unseen visual objects generally, including rats, has been constructed long ago. And my present act of supposing that the cause of the noise is a rat is not a new construction but an hypothesis.

On the other hand, the invention of the ether of space when it was required to be the carrier of light waves was not only hypothetical but was also a construction. For in this case there was posited not only the existence of the external world, but in addition the existence of a quite new kind of unperceived object.

Because hypotheses are thus concerned as much with factual existences and as with constructive existences, it seems to me that what is frequently called the 'hypothetical character of science' ought rather to be called its

constructional character, and that the use of the word hypothetical in this connexion rests on a confusion of thought. For what is meant by the so-called hypothetical character of science? Certainly not that all scientific knowledge consists in unverified hypotheses. An hypothesis, after all, ceases to be a mere hypothesis when it has been verified. It then becomes a theory or even a known fact. It was once an hypothesis that certain aberrations in the motions of the planets were caused by an unknown planet. When the existence of Neptune was verified with the telescope, our knowledge of this existence did not remain an hypothesis. It had become an observed fact. To assert that scientific knowledge is hypothetical in this sense would imply uncertainty and lack of proper verification of its conclusions. It would even imply that our knowledge of Neptune while astronomers were still calculating and searching was more 'scientific' than our knowledge of it after the telescope had been turned upon it. And this is certainly not what is meant by those who speak of the hypothetical character of science.

Do they mean, then, that science is concerned only with hypothetical propositions? This view is apparently sometimes intended, although it is plainly erroneous. It is, of course, true that science makes very wide use of hypothetical propositions, but only—it must be at once added—intending them as a means of advance towards categorical ones. Hypothesis is a *method* of seeking scientific truth. But the truth when found is in no wise hypothetical. Hypothesis is not the end at which science aims—as would seem to be almost implied by such a phrase as 'the hypothetical character of science'—but merely a means towards its ends. And its real ends are the attainment of categorical propositions.

One or two examples will make this clear. Einstein frames the hypothetical proposition 'If the geometry of space-time is such and such—which I suppose it to be—then the displacement of the orbit of Mercury will be so and so, and rays of starlight passing the limb of the sun will be bent in such and such an angle'. The displacement

of the orbit of Mercury is known, and the bending of the light rays is measured. It is found that the facts regarding both agree with the deductions from the supposed geometry of space-time which are set forth in the above hypothetical proposition. The hypothesis is then, at least to some extent, verified, and Einstein hopes to be able to frame the categorical proposition 'The structure of space-time *is* such and such'.

The physicist, again, endeavours to arrive at the truth regarding the constitution of the atom by means of tentative hypotheses. He supposes the constitution of the atom to be such that it may be described by the characters, or by the mathematical formulae, x, y, z. Taking x, y, z, to be true, he attempts to deduce from them the known properties of matter as they are observed in ordinary life and in the laboratory. If his results agree with the observed facts, this does not indeed prove that his hypothesis is true. But it shows that the hypothesis explains all the relevant facts so far discovered, and that, if no further facts which contradict it come to light, there is at least a certain degree of probability that it may be true. What the physicist hopes is that in the end it may be actually proved true, so far as such proof is possible to his science. He hopes to be able definitely to propound the categorical proposition that the nature of the atom actually *is* given by the formulae x, y, z. Or if his hypothesis is proved wrong, he hopes to hit on the right one and then prove that the nature of the atom *is* expressed in the formulae p, q, r.

Hence it is not strictly true to say that scientific knowledge is in its nature hypothetical. It is, or aims at being, categorical. Yet those who speak of its hypothetical character clearly mean something important, and are seeking to express a genuine insight. And I believe that what they are really groping for and trying to express is the *constructional* character of science. This character is stressed in the writings of the famous French mathematician Poincaré, although he too uses what I hold to be the wrong term 'hypothetical'. It comes out clearly, again, in

the passage which I have already quoted from Professor Andrade's book *The Mechanism of Nature*. Professor Andrade pointed out that even if the atoms are 'polite fictions', this will not affect the validity of the atomic theory, since it will be just as valuable in introducing order into our knowledge and promoting new discoveries.

Professor Eddington recently described certain features of the latest theory of the atom as 'a dodge, and a very good dodge too'. The only fault to be found with this statement is that the distinguished author of it seems to regard an unperceived existence or a character which is a 'dodge' as in some way different from and inferior to an unperceived existence or character which is 'really there'. He appears to think that other unperceived existences, such as the atom itself, are not dodges, but are 'really there'; whereas in truth even unperceived existences which are 'really there', including atoms and tables when no one is aware of them, are 'dodges, and very good dodges too'. And the belief that they are 'really there' is part of the dodge.

The suggestion which seems to be made by all these writers, however, is that many of the truths of science are 'polite fictions', ways of looking at the universe which enable us both to introduce order into our knowledge (the theoretical interest), and correctly to predict new experience (the practical interest), but yet that such polite fictions must not be denied the position of being genuine scientific truths. This is what is commonly referred to as the 'hypothetical character' of science. And it seems clear that this designation is inaccurate, and that we ought rather to speak of the constructional character of science. For 'polite fictions' are clearly constructions.

The essential distinction, then, between hypothesis and construction is that the construction is always a pure creation of the mind, and the existence posited by it, if any, is always a constructive existence; whereas an hypothesis need not possess this character. The existence posited by it may be factual, as is the case with the rat and the planet Neptune. It is true that an hypothesis may sometimes also be itself a construction. The present

theory of the atom must, I think it will be admitted, be regarded as still an hypothesis, not a proved truth. And it is also, as I shall show more definitely later, a construction. So that some hypotheses are also constructions and posit constructive existences. But this is not essential to the character of hypothesis as hypothesis. The existence posited by a construction is always constructive. The existence posited by an hypothesis may be either factual or constructive.

We may sum up the results of this chapter as follows:

(1) A fact is something actually perceived.[1]

(2) The essential character of mental constructions is that they are pure creations of the mind to which no facts correspond.

(3) Existences which are posited by an hypothesis may be either factual or constructive.

(4) Though the method of science may be largely the method of hypothesis, yet the nature of scientific truth as such is not hypothetical. It is, however, constructional. And this is apparently what is meant by those writers who erroneously refer to the 'hypothetical character' of science.

[1] This is subject to the qualification that the mind which perceives or knows is itself also a fact. This will be brought out in the next chapter.