

III.—THE CHRISTIAN DOCTRINE OF CREATION AND THE RISE OF MODERN NATURAL SCIENCE.¹

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For the convenience of this article I shall use the term "modern science" in a restricted sense, so as to exclude from consideration its most recent developments. Thus by "modern physics" I mean what is now sometimes called "the classical physics". I do this not because I wish to imply that what I say of it is not true also of the most recent developments of science, but because I do not wish to raise the question here whether it is or not.

I approach my subject by way of a consideration of modern philosophy, and I apply the term "modern" to philosophy with a similar restriction, meaning by "modern philosophy" the philosophy which arose at the end of the Middle Ages and developed along the two main lines of Empiricism and Rationalism from Hobbes to Hume and from Descartes to Leibniz. About this philosophy as a whole I shall make two assumptions which I think will not be disputed. The first is that it was devoted (in so far as it was concerned with a theory of nature) mainly to establishing the possibility or justifying the presuppositions of the modern science of nature. It is necessary to use these two alternative descriptions because the relation of philosophy to science varied according to the degree of development which the latter had achieved at the time. By the later centuries of the modern era the sciences of nature had become so firmly established that they formed a datum from which philosophical speculation could start. This does not of course mean that the philosopher dogmatically accepted the truth of any scientific hypothesis.

¹ I have anticipated something of what is said in this article in a paper entitled "The opposition between Hegel and the philosophy of Empiricism" which was read at the third Congress of the International Hegel Society at Rome, Easter, 1933, and published among the proceedings of the Congress. The subjects of the two papers are different enough to be largely complementary, but where they overlap I have not hesitated to repeat my arguments.

He assumed only that a science of nature was possible (because it was actual), enquired into the presuppositions of its possibility, and tested his conclusions by their compatibility with it. This procedure is what Kant first named the Critical Method, but it was to some extent unconsciously anticipated by his predecessors in the later portion of the period which we are considering. But the assertions made about nature by the earlier philosophers of this period, while the sciences of nature were still in the founding, could not be grounded by such a method. Obviously the argument that nature must be such and such because otherwise the science of nature would not be possible, is cogent only when it is granted that the science of nature is actual. What I wish admitted is simply that these pioneers of modern philosophy, writing before the modern science of nature was fully established and not grounding their conclusions on its existence, did yet ascribe to the world of nature those very characteristics which the modern science of nature must presuppose in it as the condition of its own possibility. Thus Descartes, for example, denied that final causes are operative in nature; and modern physics was based upon the presupposition that final causes are not operative in nature. Locke declared that the Real Essence of natural objects was unknowable; and the modern empirical sciences of nature presupposed that the real essence of their objects was unknowable.¹ In a word: the early modern philosophers ascribed to nature the character which constituted it a possible object of modern natural science in advance of the actual establishment of that science.

I wish it admitted, secondly, that, these modern doctrines of nature being, as they were felt by their authors to be, incompatible with the Aristotelian doctrine of nature maintained in the Scholastic philosophy, precisely the element in them which is alien to Aristotle is the ground of the peculiar characteristics by which modern natural science is distinguished from the science of the Greeks or the Scholastics. Thus, to take the same two examples, when Locke asserts that the real essence of natural objects is unknowable, he is both contradicting Aristotle and by the same assertion ascribing to nature the characteristic which necessitates in the science of it that empirical quality by which the modern inductive sciences are distinguished from any science which had preceded them. When Descartes declares that only efficient causes operate in nature, he is substituting for the Aristotelian conception of nature another incompatible with it; and

¹ Because if it were knowable, properties of the object would be deducible from it, not established by the evidence of experience.

the difference between the Cartesian and the Aristotelian conceptions of nature is the ground of the difference between the modern science of physics and its ancient counterpart.

The general question arises : What is the source of the un-Greek elements which were imported into philosophy by the post-Reformation philosophers, and which constitute the modernity of modern philosophy ? And the particular question—which is merely part of the general question repeated : What is the source of those un-Greek elements in the modern theory of nature by which the peculiar character of the modern science of nature was to be determined ? The answer to the first question is : The Christian revelation, and the answer to the second : The Christian doctrine of creation. The main object of this article is limited to establishing the answer to the particular question, but I will preface the attempt by a few remarks upon the general one.

Opposition to Greek philosophy in general, and to that of Aristotle in particular, was not raised for the first time in history when the post-Reformation philosophers rejected Scholasticism. On the contrary, the opposition between Christian revelation and Greek philosophy was as old as Christianity itself, and the endeavour to overcome it through the progressive assimilation of Christian dogmas by the philosophical understanding was the spring of the whole development of medieval philosophy.¹ Scholasticism itself is much more than a re-edition of Aristotle. If we ask from what source this *plus* is derived, there can be only one answer : it is clearly and obviously derived from the Christian revelation. My contention is that the conflict waged against Aristotle after the Reformation was only a continuation of the conflict waged against him before it ; that as the one party in this opposition (Greek philosophy) remained the same after as before the Reformation, so also the other remained the same ; and that the un-Greek element in modern has the same source as the un-Greek element in medieval philosophy : namely the Christian revelation. There is hardly a stronger argument for the truth of this contention than to draw the consequences of denying it. If we deny it we must suppose both that the un-Greek (*i.e.*, specifically modern) element in modern philosophy was without a source, and that the un-Greek (*i.e.*, specifically

¹ This is brought out with fine lucidity in É. Gilson's *L'esprit de la philosophie médiévale*. But my whole article is a protest against Gilson's further assumption, that we must look to a resurrection of Scholasticism for a continuation of this great task, and against his implied judgment that the work of the classical modern philosophers represents a declension from the path upon which medieval philosophy set out.

medieval) element in medieval philosophy was without an issue. This supposition can hardly even be entertained by one who has not been hardened in the belief that the history of philosophy begins again *de novo* with Descartes.

To say this is by no means to deny that there was a crisis in the history of thought at the time of the Reformation or that modern differs from medieval philosophy in vitally important respects. The effect of the Reformation in the sphere of thought was analogous in two ways to its effects in the sphere of conduct. In the latter sphere it had the effect, first, of extending the Christian order of conduct from the religious (*i.e.*, monastic) to the secular life. This involved, of course, the disappearance of the 'religious' life as such, but by no means therefore of the principles by which it had been governed. They continued to be applied, with a rigour only intensified by their diffusion, in the Puritan asceticism of the economic life.¹ The Reformation had the consequence, secondly, of transferring the direction of conduct from the external authority of the priest to the internal authority of conscience. But conscience only imposed from within the same laws of conduct which the priest had imposed from without. The Reformation marks a term in the education of the Christian peoples analogous to that which Aristotle proposes as the end of the ethical training of the individual. The first stage in the acquisition of virtue by the individual is his submission to certain principles of conduct prescribed by another, but the end of this submission is his acquirement of a disposition to act in accordance with these principles. When this is achieved, he is emancipated from his tutelage, and his actions are determined henceforth from within himself. But this does not in the least imply that his actions are now liberated from the control of the principles to which they were formerly submitted. It means simply that they are now animated by these principles whereas previously they were conformed to them. Similarly, at the Reformation conduct was emancipated not from direction by Christian principles, but only from their external prescription. Conscience itself was an 'acquired disposition', informed by submission to that very prescription, and if its possessors could mistake it for a 'natural' faculty, that was only because it had been acquired so thoroughly.²

¹ I refer especially to Max Weber's great work, *Die protestantische Ethik und der Geist des Kapitalismus*.

² "Der gesunde Menschenverstand und das natürliche Gefühl roher Türken zum Mass-stab genommen, gibt abscheuliche Grundsätze. Wenn wir aber von gesundem Menschenverstand sprechen, von natürlichem

In the sphere of thought the Reformation had effects analogous to both of these. In the first place (I am reversing the order), philosophers claimed for reason emancipation from the authority of faith, to which it had been so long submitted. They did not realise that the reason for which they claimed autonomy was a reason itself informed by this very submission, and that what they called 'common sense' or 'the natural light' was only an internal revelation of what had previously been revealed externally to faith. If the reason upon which they relied had been in fact what they took it for, a 'natural' faculty bereft of the enlightenment of the Christian revelation, it could have discovered no truths not discovered by reason to the Greeks, and could not therefore have laid down the foundations upon which modern science was raised.

The delusion of the early modern philosophers that their philosophy was based wholly on the evidence of reason ¹ (if they were Rationalists) or of experience (if they were Empiricists) prevented them from looking further for the source of their doctrines, or from so much as entertaining the supposition that they were indebted to Christian revelation. But it has been open to no succeeding philosopher to share the delusion. The work of criticism very speedily showed that neither the Rationalist nor the Empiricist philosophy was really based upon the evidence upon which it pretended to rely. No experience, to take one example, could serve as evidence to Locke of the existence of material substances, nor any reasoning demonstrate to Descartes the existence of a material world. No doubt, the assurance of 'common sense' might suffice for the one, and of the 'natural light' for the other. But then it must be admitted that "common sense" is something other than sense and the "natural light" something other than reason; and the way is open for the

Gefühl, so hat man dabei immer im Sinn einen gebildeten Geist; und die, welche die gesunde Menschenvernunft, das natürliche Wissen, die unmittelbaren Gefühle und Offenbarungen in ihnen zur Regel und Massstab machen, wissen nicht, dass, wenn Religion, das Sittliche, Rechtliche sich als Inhalt in der Menschenbrust findet, dies der Bildung und Erziehung verdankt wurde, die nur erst solche Grundsätze zu natürlichen Gefühlen gemacht haben." Hegel, *Geschichte der Philosophie*, III., ii., 2; *Werke*, 2nd ed., vol. XV., p. 439.

¹ When Raymond de Sebonde declares in the prologue to his *Theologia Naturalis sive Liber Creaturarum*, that the exercise of the natural reason upon the Book of Nature suffices a man to know without difficulty "whatever is contained in Holy Scripture" (C. C. J. Webb, *Studies in the History of Natural Theology*, p. 292 ff.), that is only an extreme form of the delusion shared in some degree by all the modern Rationalist philosophies.

enquiry: What is the source of that certainty which is derived neither from reason nor from sense? ¹

It will not be enough to show that this certainty had its source in the Christian revelation; it has to be shown also that it had its issue in the establishment of the presuppositions of modern natural science. That these presuppositions are not themselves established by the evidence either of reason or of sense, any acquaintance with the "problem of induction" or with Hume's difficulties about causation is sufficient to show. And in fact the criticism to which the Rationalist and Empiricist philosophies were subjected, in divesting them of all those conclusions to which they were not *upon their own premises* entitled, did divest them of every certainty which the procedure of modern natural science requires for its justification. If these philosophies had never laid themselves open to that criticism, if they had begun by resigning themselves to the scepticism to which they were ultimately reduced; or if, having laid themselves open to it, they had succumbed to it too soon—they would not have performed the function which in fact they performed in the establishment of modern science. What prevented them from succumbing sooner was their reliance upon the revelation which had raised them above scepticism in the first place. Regius and Malebranche, for example, being unable to defend against criticism Descartes' demonstration of the existence of the material world, do not therefore surrender the doctrine; they only recur overtly to the authority of revelation to establish a truth which Descartes had referred to the deliverance of the natural light. The very ease with which this transition is made is sufficient to indicate that Descartes' 'natural light' was informed by the same revelation.

¹ Mr. A. K. Stout ("Descartes' Proof of the Existence of Matter", *MIND*, April, 1932) has argued that Descartes' own doctrine is not that the existence of the material world is assured directly by the 'natural light', but that it is assured directly by something which Descartes distinguishes from the 'natural light' as the 'teaching of nature', and by the 'natural light' only indirectly, inasmuch as it is competent to establish the general veracity of the 'teaching of nature' (though not the truth of any particular one of its dictates).

Acceptance of Mr. Stout's conclusions (which I am by no means disposed to question) would necessitate a certain revision of my terminology, but not any essential modification of my argument. However significant it may be that Descartes should have admitted the existence of a source of certainty other than reason, the admission is practically nullified by the proviso that the general veracity of the 'teaching of nature' must be demonstrable by reason. The proviso makes the certainty of the existence of matter to depend ultimately, if not immediately, upon the 'natural light'.

The time came much later when the appeal to revelation lost the power of directing thought. Kant, who was perhaps the first to perceive quite clearly that the *whole* of the ontological doctrines of modern Rationalism were covertly dependent upon the authority of revelation, regarded this as a sufficient ground for dismissing them, and not as a confirmation of their truth. But by this time the 'dogmatic' philosophies had done their work. A body of natural sciences had arisen upon the presuppositions which they had laid down, and it was possible *now* for the philosopher to establish the presuppositions by the 'critical' method of working back to them from the sciences which were based upon them. During the whole period in which the modern natural sciences were in an early stage of growth the influence of religious authority upon philosophical thought was consistently exerted to preserve it from conclusions, whether sceptical or otherwise, which would have been incompatible with the possibility of these sciences; and religion surrendered this control only when the sciences were established firmly enough to serve in their turn as a datum for philosophical speculation. I will give an illustration at the risk of anticipating what belongs later. Descartes and Kant both reject final causation in nature, but their arguments differ significantly. Kant argues in effect from the absence of final reasoning in science to the absence of final causation in nature; nature must be without final causes because it is presupposed to be so by the science of mathematical physics. But Descartes proceeds in the reverse direction. The avoidance of final explanations by the physicist is not cited as a fact, but prescribed as a rule. The scientist, he says, *ought* to abjure the search for final explanations *because the purposes of God are inscrutable*. This argument is an enthymeme of which the premises to be supplied are that nature is *created* by God, and that the activity of creation is not directed by an intelligible purpose. So that Descartes' prescription to the physicist is based upon the metaphysical implications of Christian dogma.¹

¹ The same connection may be illustrated by another example. Of Aquinas's presentation of the doctrine of the 'star-moving Intelligences' Prof. Webb remarks that "the chief interest to us of these speculations . . . lies in the fact that Thomas Aquinas is so thoroughly alive to the danger involved to the *religious principles of Christianity* in the acknowledgement of the divinity of the heavenly bodies" (*Studies in the History of Natural Theology*, p. 274. *My italics*). Acknowledgement of their divinity was the basis of the distinction between Celestial and Terrestrial physics, with the abolition of which modern physical science may almost be said to have begun. There could hardly be more striking evidence of the truth of my thesis than the fact that this criticism was first undertaken in the interest of the religious principles of Christianity.

In the second place, as the Reformation in the practical sphere had the effect of extending the application of Christian principles of conduct beyond the religious to the secular life, so in the theoretical sphere it carried out the implications of Christian doctrines beyond the sacred into the profane sciences. The mediæval philosopher had of course believed the Christian doctrine that nature is created. But the belief had been efficacious only in his theology. In his science of nature he had continued to seek for final causes, to define essences and to deduce properties : in a word—he had continued to employ the methods of Aristotelian science, entirely oblivious of the fact that Aristotle's science was based upon the presupposition that nature is not created. The modern investigators of nature were the first to take seriously *in their science* the Christian doctrine that nature is created, and the main differences between the methods of ancient and the methods of modern natural science may be reduced to this : that these are and those are not methods proper to the investigation of a created nature.

With this we may turn to a closer examination of the particular question. We have to determine, first, what the differences are which distinguish the methods of modern from those of Greek natural science ; we have to show that these differences depend upon differences between the modern and the Greek philosophy of nature, and that these in their turn are derived from the differences between the Christian and the Greek conception of God and of God's relation to the world.

I have said what I shall mean by the term 'modern science of nature', but it might appear a difficulty to determine what is to be meant by the contrasted term 'Greek science of nature'. Greek science of nature was in most of its branches an attempt rather than an achievement, and an enquiry into its character might seem to be surrounded by all the difficulties which attend an investigation of the rudimentary and the embryonic. Even to determine what its methods were might seem to require an antiquarian learning which I am far from possessing and which could in any event hardly promise to yield results of philosophical importance.

I shall not embark on such an investigation and my purpose does not require that I should do so. We need not elicit the principles of Greek science from the vestiges of Greek sciences, because we possess a classical formulation of the principles in the Aristotelian Logic. By Greek science I shall mean such science, or attempted science, of nature as conformed to the canons of Aristotelian Logic ; and I shall not be disturbed by the

fact, if it be one, that the Greeks developed some sciences not so conformable ; or that the systematic attempt to apply Aristotelian methods to the investigation of nature was characteristic rather of the medieval scholastics than of the Greek philosophers. The peculiar characteristics by which modern is to be distinguished from Greek natural science may consequently be determined simply as those which render the former unconformable to the canons of this logic.¹

Judged by this criterion one of the most important and striking differences, though no doubt it is not the only difference, between the methods of modern and those of ancient natural science is the presence in the former of an empirical element lacking in the latter. Modern science describes natural substances instead of defining them, it discovers their properties by observation and experiment instead of by 'intuitive induction' and demonstration, it classifies their species instead of dividing their genera, it establishes between them the relation of cause and effect instead of the relation of ground and consequent. In each case the modern procedure will be found to differ from its ancient counterpart by the part which sensuous experience plays in it. This is not to say that sensuous experience played no part in ancient science, but that it played a different part : it supplied the illustration but not the evidence of the conclusions of science.²

All the peculiarities of Greek natural science are derived from the assumption that the essence of a natural object is definable, as the essence of a geometrical object is. Once let this be granted, and it follows that the properties must be deducible by reason from the essence, the species derivable by reasoning from the concept of the genus, the necessary connections between it and other objects such as can be perceived by reason to be involved in the essence ; it follows, in a word, that empirical evidence must be inadmissible in the same degree and for the same reason in establishing the conclusions of natural science as it obviously is in establishing the conclusions of Euclidean geometry.

The methods of Greek natural science thus depend upon the assumption that the essences of natural objects are definable. What does this scientific assumption presuppose about the nature of the physical world ?

Definition is an act of reason containing no element of sense, however necessary it may be that sensuous perception should

¹ Cf. in this connection C. R. Morris, *Idealistic Logic*, chap. iv.

² This is not, of course, the point at issue between Aristotle and Plato. They differ only in estimating differently the importance to be assigned to the sensible *as illustration*.

precede it. No doubt I must have seen lines, or touched them, before I can define the line. But when I have reached a definition, then 'the line' which I have defined is intelligible only, neither visible nor tangible. That in objects which is intelligible as distinct from sensible is what the Greeks called their form as distinct from their matter. That the form of things is intelligible, and therefore definable, does not of itself constitute the whole of the assumption required to justify the procedure of Greek science, namely that the *essence* of things is intelligible, and therefore definable. It needs the complementary assumption, which the Greeks also made, that the form of things is their essence, *i.e.*, that of the two elements, formal and material, of which every actual thing is composed, the form alone makes the thing to be what it is, whereas the matter contributes no positive element to its being. Matter is the correlative, in the object, of sense in the subject, as form is the correlative of reason; and thus the Greek assumption about science, that there can be no empirical evidence for scientific conclusions, depends upon the Greek assumption about nature which may be loosely designated the assumption of the 'unreality of matter'. The designation is loose, because it is not meant simply that matter is not actual except in union with form; for it is true equally, at least according to Aristotle, to say that form is not actual except in union with matter. What is meant is that the *σύνολον* of matter and form, which alone is actual, is determined to be what it is wholly by the one element of form. The object is *nothing more than* a realisation of form; its matter is the source of no being in it over and above that which it derives from its form, it is the source only of the imperfection with which the latter is realised. The method of Greek natural science thus involves a theory of nature according to which the actual world is distinguishable into the two elements of form and matter, the former intelligible, the latter sensible. Because the 'intelligible nature' is the ground both of all being and of all action in the actual world, whereas matter accounts only for diminution of being and impediment of action, it follows that intelligent comprehension of form is sufficient for the understanding both of what is and of what happens in the actual world, so far as this is capable of being understood, whereas sensuous experience represents no addition to, but only defect of, such understanding.

We have to ask finally what theory of God is presupposed in this theory of nature, and here I shall invert the natural order of investigation by stating my conclusion first. The theory of nature presupposes that neither of the two elements of which

nature is composed is dependent for its being upon a power outside nature, *i.e.*, that neither of them is created. If matter were created it would possess a positive being, if form were created it would not be intelligible. The twin Greek doctrines of the 'unreality' of matter and the intelligibility of form imply that matter and form are alike eternal. We may say in advance, then, that any development of Greek theology, if it is to remain consistent with the presuppositions of Greek natural science, must stop short of the attribution to God of an omnipotent power over nature. Nature may be conceived as dependent upon a supernatural power for the activity by which its two elements are conjoined, but not for the being of either element. I shall endeavour to show, in the briefest possible outline, how Greek theology observes this limitation even in its highest developments, and I shall make some remarks upon each in turn of the three following Greek theological conceptions: (i) the conception of God as identical with nature, or of nature as itself divine, (ii) the conception of God as subject of a purely theoretical activity, (iii) the conception of God as artificer or Demiurge of nature.

(i) The identification of God with Nature finds its earliest expression in the deification of natural powers which is characteristic of the Greek polytheistic religion. So long as this identification is both naïve and complete, so long, *e.g.*, as the god is simply not distinguished at all from the natural object, it does not seem, indeed, that the religion founded upon it can give rise either to a theology or to a science of nature. But Greek¹ religion, though it may have begun with such a naïve identification, did not end with it. The withdrawal of the Gods to

¹ I am using the term 'Greek' with an arbitrary limitation of meaning. By 'Greek religion' I mean the Greek Olympian religion, by 'Greek philosophy' the tradition of philosophy which began with Socrates and culminated in Aristotle, by 'Greek natural science' the science of nature based upon that philosophy, the actual pursuit of which was perhaps rather characteristic of Medieval Scholasticism than of the Greeks themselves. I need hardly say that I do not intend to deny the existence of what I ignore. There was, of course, a Greek religion other than the Olympian, a Greek philosophy before Socrates (there seems to have been a close connection between pre-Socratic philosophy and extra-Olympian religion), and there were at least the rudiments of a Greek natural science which was not a science of formal causes. Reaction against Aristotle in the early-modern philosophers was often enough accompanied by a renaissance of the theories of pre-Socratic philosophers. It remains none the less true that the reaction derived its force from Christian dogma, and only its watchwords from the pre-Socratics. These doctrines were revived and others discarded because these were more readily conformable to the doctrine of Creation.

Olympus implies the recognition of *some* distinction between the natural and the divine. This is no absolute distinction ; if it had been, Greek religion would have cast off at a stroke the character which distinguishes it as pagan from either the Jewish or the Christian ; but it was sufficient to entail that the sensible object should be regarded henceforth not simply as the god, but as the *appearance* of the god, and its growth or motion rather as the *manifestation* of a divine activity, than as being itself divine.

This partial distinction between God and nature supplied the foundations of Greek science, for the Greek did not free himself from the teachings of his religion when he became a philosopher. The attitude of belief, no doubt, gave way in him to that of understanding, but what he now understood was only what he had previously believed. The great philosophical distinction which Socrates initiated and Plato worked out between the idea and the sensible object was only the explication of the distinction which had been already made in Greek religion between the God and the sensible object.

It will hardly be denied that this philosophical distinction was the foundation of the Greek science of nature, and if it be granted that the possibility of Greek natural science depended ultimately upon the distinction between God and nature achieved even by Greek religion, there may be a readier acceptance of the thesis that the far higher development of modern natural science depends upon the far deeper distinction between God and nature achieved by the Christian religion. The limitations of the pagan distinction are reflected in the peculiarities of Greek scientific procedure. If the gods are to be distinguished from nature, and yet not completely distinguished from it, they must be conceived as *appearing* in nature and as natural objects. The same difficulty concerning the relation of the sensible to the supersensible arises within the Platonic philosophy, and the solution of it is the same : the sensible is related to the idea as appearance to that which appears. The application of these categories to nature implies that the sensible (which is the material) is, *quâ* sensible and material, merely apparent, and this implication justifies the *a priori* methods of Greek natural science. But the doctrine of Creation implies that the material is real *quâ* material.

It is true that the doctrine of nature implicit in Greek polytheism is not of itself sufficient to supply the presuppositions even of Greek natural science. That the forms should be isolable in thought from the accidents of their material embodiment, is not sufficient to constitute them proper objects of a science. A scientific understanding (as distinct from a still quasi-æsthetic

contemplation) demands that its objects be perceived to be inter-related one with another as members of a single system,¹ and this involves a view of the universe different from that involved in any mere polytheism. On the other hand, it does not involve any form of Theism, or belief in a God transcending nature. Nature must be conceived as a unity, but the principle which constitutes it one need not, for any of the considerations yet advanced, be held to possess an existence apart from nature, or to be related to the multiplicity of natural objects in any other wise than that, *e.g.*, in which the principle of life in an organism is related to its bodily members. Though this principle of unity may be termed 'God', it is God only in the sense in which that term is compatible with Pantheism, or a God still imperfectly distinguished from nature. The Greek, in other words, in becoming a monotheist did not necessarily thereby cease to be a pagan; and Pantheism is no less incompatible than polytheism with the attribution of reality to sensible particulars.

(ii) There are Greek theological doctrines which transcend the limitations of Paganism. I shall content myself here with considering two of these, with pointing out in what respects they differ from the doctrine of God as Creator, and with trying to show that it is precisely in virtue of these points of difference that they are enabled to remain compatible with the Greek theory of nature, especially in the two crucial regards which I have mentioned.

The first of these is Aristotle's conception of God as First Mover. It is not without significance for my thesis that Aristotle's proof of the existence of a transcendent God is based upon the necessity of accounting for the communication of motion by efficient causes in nature; in other words, that he approaches most nearly to the Christian doctrine of God at the very point at which his conception of nature approximates most closely to that of modern physics. But Aristotle's God, though admitted to be transcendent, is bereft of any power over nature except the single power of originating motion. Neither the matter nor the form of natural objects depends on him; and even of motion in nature he is not himself the efficient but only the final cause. He is not the source of energy in nature; that must be held to arise within nature from the active potency of the form to realise itself; but is only the end upon which all energy in nature is directed. The only activity of which God is the source is his own

¹ The possibility of syllogistic inference in especial depends upon the systematic interrelation of species.

theoretical activity ; and this activity terminates not upon the world but upon himself.

It may well be questioned whether Aristotle's restriction of God's operation upon the world is really consistent with his argument for God's transcendence ; whether, in other words, that argument does not demand the conclusion that motion in nature has a source as well as an end outside nature. However this may be, it is certainly that restriction which enables Aristotle to retain essentially unmodified the conception of nature already outlined. Nature owes God nothing except that harmony of its operations one with another which they derive from their direction upon a single end ; and which might in fact be as well accounted for by the Pantheistic hypothesis, that nature is animated by a single soul.

The attribution to God of an activity of will sweeps away this restriction, and with it the possibility of maintaining the Pagan conception of nature as self-dependent.

(iii) There is one Greek doctrine of God which ascribes to him a power of efficient causation in the constitution of the actual world. This is Plato's doctrine of the Demiurge or Artificer, and because this, of all Greek theological doctrines, bears the closest superficial resemblance to the Christian doctrine of Creation it will serve best to throw into relief the essential contrast which still persists between the conception of God as Creator and any conception of the divine activity which is consistent with the presuppositions of Greek natural science. The doctrine that God is a Demiurge is perfectly consistent with them, because the activity of a Demiurge (the activity which the Greeks called *Techne*) is essentially both (i) *informative* and (ii) *purposive*, that is to say, it is (i) confined to the information of a given matter, and (ii) directed by the antecedent conception of an end. The activity consists in the realisation in matter of the end, which becomes by realisation the form or essence of the object produced, but since the form must be conceived by the workman *before* he starts his work it cannot derive its being, but only its embodiment, from his activity. The form must be "given" to the Demiurge no less than the matter of his work ; thus, if God is Demiurge of the actual world, his work is confined to the uniting of its two elements, form and matter, but cannot extend to the bringing into being of either element.

The ascription to God of the activity of a Demiurge is thus compatible with the fundamental assumption of Greek natural science, that form and matter are eternal. We may, indeed, see more vividly what is involved in this assumption if we reflect

that to make it is to attribute to natural objects *a constitution identical with that of the products of a Techne*. Plato in the *Timæus* may be unique in asserting that the natural world is the product of a Demiurge; but Aristotle asserts,¹ and all the methods of Aristotelian science presuppose, that natural objects *are as though they were* the work of a Demiurge.

We may illustrate the connection between this presupposition and those methods by an analogy. Any product of one of the useful arts is clearly and indisputably the work of an artificer. If we imagine an investigator (say an archaeologist who has uncovered the remains of an unknown civilisation) confronted with a collection of unfamiliar artefacts, it will be possible for him, provided only that he knows them to be artefacts, to institute an enquiry into them by an application of the very methods which Aristotle thought proper to a study of nature.

His first task will be to determine what the different objects are, or to define them; the initial assumption that they are products of an artificer involves the consequence that they are capable of definition. His method of determination will be that of intuitive, not of empirical induction, and what he determines will be the real, not the nominal essence of the objects. He will collect the greatest possible variety of examples of each kind, and will observe their sensible qualities, but his procedure will not be that of the empirical scientist as Locke, *e.g.*, describes it in his doctrine of Abstraction. He will not tabulate the sensible qualities which all his examples have in common, assign a general name to such a complex of qualities, and determine to call by that name in future every object which shall be found to possess all of them. On the contrary, he will use his variety of sensible examples as the geometrician may use a variety of drawn figures, strictly as illustrations, and to facilitate his passage by an act of intuitive reason to a comprehension of something which is not itself sensible at all, but is the reason (*λόγος*) of the object.² What is comprehended will be at once the end which governed

¹ Cf. *Physics*, II., 8, 199a, 12. *εἰ οἰκία τῶν φύσει γιγνομένων ἦν, οὕτως ἂν ἐγένετο ὡς νῦν ἀπὸ τέχνης· εἰ δὲ τὰ φύσει μὴ μόνον φύσει ἀλλὰ καὶ τέχνῃ γίγναιτο, ὡσαύτως ἂν γίνοιτο ἢ πέφυκεν, and *ib.* 6, 30. Natural objects differ from products of art according to Aristotle only in the one respect, not relevant to the present issue, that they have their principle of action within them.*

² "We found cuttings in the rocks which puzzled us for a long time, till I, who had seen the same in Syria, discovered that they were winepresses" (*Letters of Gertrude Bell*, I., p. 240). This discovery was not a detection by any of the senses of a sensible quality which had hitherto eluded them; what is discovered could not have been rendered *visible* by any microscope.

the design of the artificer, and at the same time the form of the product (since it is clearly that in the product which the artificer added to his materials, *i.e.*, is that element in it which is to be distinguished from the material). It will be the real essence, because the end conceived by the artificer will in fact have caused the product to possess the qualities (its peculiar spatial configuration, *e.g.*), which it is found to have ; and hence discovery of the essence will enable the investigator to understand the reason of what he had previously only observed to be a fact.¹

The essence once defined can serve as the ground of demonstration of essential properties ; if an object is to serve a given purpose, it must possess such properties as are evidently indispensable to its fulfilment.

Definition of the essence makes possible its subsumption under a genus and its differentiation into subordinate species by the method of Division : a method differing from that of empirical classification in that it proceeds *a priori* by an insight into the essential nature of a thing, not *a posteriori* by comparison of similar sensible qualities.²

That properties should be demonstrable *a priori* of the essence and that species should be subsumable *a priori* under genera, these are the two conditions necessary for the possibility of a Syllogistic inference which should be free from the fallacy of *Petitio Principii*. The investigator we have imagined could make a fruitful use of the syllogism in constructing a science of his manufactured articles.

In a word : their susceptibility of definition makes it possible to apply to manufactured articles all the other Aristotelian methods. The science of nature would conform similarly to the canons of Aristotelian Logic *if nature were the work of a Demiurge*.

For an object to be definable, two conditions must be satisfied : (i) its form must be intelligible, and (ii) its form must be its real essence. Both conditions are satisfied by the products of a

¹ Of a jug, *e.g.*, the experience of his senses can inform him that it has a flat base and a projecting lip ; but only a discovery of its purpose can enable him to understand why it has.

² Thus the unknown artefacts of our illustration could be classified empirically in any of a variety of ways according to similarity of sensible characteristics (colour, *e.g.*, texture of surface or size) by one who did not know their purpose ; or even if they had had none. But the discovery of the one true system of genera and species, according to which a given object is to be classed, *e.g.*, as a kind of lamp, and not as a species co-ordinate with the sauce-dishes which it resembles in appearance : this presupposes knowledge of the purpose of the objects and is achieved by methods different from those of empirical classification.

Techne, and the possibility of an Aristotelian science of nature depends upon the assumption that both conditions are fulfilled by natural objects.

But the doctrine that nature is created involves the denial that natural objects can satisfy either condition.

(i) That the form of an object is intelligible, means that it is distinguishable in conception from the sensible material of its embodiment. The form of an artefact is thus distinguishable, because the activity of the Demiurge who made it was purposive, that is to say, was directed by conception of an end. What he conceived as end, we distinguish as form; and we are enabled to conceive in distinction from sensible accidents precisely so much as he conceived in advance of his execution.

But the work of creation is not purposive; and as there is no end distinctly conceived by the creator in advance of his execution, so there is no form distinguishable by us from the accidents of its embodiment. This may be most easily seen in the contrast of fine or creative art with the activity of a Demiurge or artificer. It is notorious that the creative artist, *e.g.*, the painter, has no clear knowledge of what he is going to achieve before he has achieved it; and the critic on his side, when confronted with a work of creative art, is indeed aware that there is 'something more' in it than the sensible material—a great painting is more than a certain complexity of coloured surfaces—but this 'something more' (we may call it loosely 'the meaning') is *not* capable of being conceived in distinction from the sensible material in which it is expressed. The meaning of a painting is not intelligible in the sense in which the purpose of a wheelbarrow is.

The form of natural objects would be distinguishable (and the objects therefore definable) only if the activity of God were purposive, *i.e.*, directed upon an end which is not itself the product of his activity. But if God is a Creator, natural objects can have no form distinguishable as the object of the intellect.

(ii) The doctrine of Creation attributes to God an autonomous activity of will. No doubt it is also implied in the conception of God as a Demiurge that he is the subject of some practical action. His work is not exhausted according to this doctrine in the theoretical contemplation of the forms, but he engages beyond that contemplation in the non-theoretical activity of embodying them. But it is characteristic of the work of a Demiurge that in it the practical is wholly subordinated to the theoretical activity. The entire activity of the craftsman, in so far as he is a craftsman, is dictated by the end or plan which is the object of his theoretical conception. No doubt the will of any human artificer may escape

from this dictation by his reason ; he may add details to his work which are not necessitated by the dictates of his craft (if he is a bad workman) or are even contrary to them (if he is a corrupt one). But this insubordination of will is a mere defect and simple failure to achieve the perfection of an artificer.

That in an artificial object which is not necessitated by its idea is the *contingent*, and just as the insubordination of will is nothing but an imperfection in the artificer, so the presence of the contingent is nothing but a defect in the artefact.

Bad workmanship is not the only cause of contingency in the product. This may arise also from recalcitrance of the material ; and since bad workmanship cannot be argued in the divine Demiurge, contingency in the natural world must be attributed to this source. Natural objects are contingent, *i.e.*, they fail to conform to their idea, precisely in so far as they are material.

Now if natural objects either are artefacts (according to the theory of the divine Demiurge) or are (according to the Aristotelian theory) in this respect analogous to artefacts that they *are* nothing but an embodiment of form, then the unavoidable element of contingency which they derive from their matter is nothing but a defect of their being. It does not make them something more than an embodiment of form, but makes them only a bad embodiment of form ; just as two inches more on one leg of a table does not make it more than an artefact, but only a bad artefact.

Objects are intelligible in so far as they are informed, sensible in so far as they are material. The contingent, therefore, or that in them which is not derived from their form, is sensible only, without being intelligible. But since the contingent has been found to represent only a defect of being, it will follow that natural objects are sensible only in so far as they fail to achieve their being. That in them which constitutes them objects of sensation is no increment, but only a defect of their intelligible nature ; and therefore sensation can contribute no evidence concerning the nature of the thing which should be additional to what is perceived by reason. As the being material is a defect and not an increment of being, sensation is an imperfection of knowledge,¹ not a way of knowing.

The absence of an empirical element in Greek natural science follows from this.

But the will of the maker can be subordinated to his reason, as the will of the Demiurge is, only so long as "making" is identi-

¹ It is at the very most the *occasion* of knowledge.

fied with formation, because form alone can be the object of reason. In the creative act the will must exceed any regulations which reason can prescribe. That is to say, the 'insubordination' of will to reason, which could be only a defect in God so long as God is conceived as Demiurge, becomes essential to his activity so soon as he is thought of as Creator. It is what constitutes him, not a bad Demiurge, but something altogether more than a Demiurge.

The *voluntary* activity of the Creator (*i.e.*, that in his activity which exceeds determination by reason) terminates on the *contingent* being of the creature (*i.e.*, on that element of its being which eludes determination by form, namely its matter and the characteristics which it possesses *quâ* material). If such voluntary activity is essential to God, it follows that the element of contingency is essential to what he creates. So soon as nature is conceived to be created by God, the contingent becomes more than an imperfection in the embodiment of form; it is precisely what constitutes a natural object more than an embodiment, namely a creature.¹

But the contingent is knowable only by sensuous experience. If, therefore, the contingent is essential to nature, experience must be indispensable to the science of nature; and *not* indispensable merely as a stage through which the human scientist must pass on his way to attaining adequate knowledge by reason, but indispensable because knowledge by reason cannot be adequate to a nature which is essentially something more than an embodiment of form. This 'something more', the element in nature which depends upon the *voluntary* activity of God, is incapable of becoming an object to reason, and science therefore must de-

¹ I suggest that we use the term "real" to attribute to a thing the being which is proper to a created object. Its meaning differs from that of the Greek *ὄν* precisely as created from uncreated being. That is why, for instance, reality is incapable of degrees, whereas *οὐρία* was capable of an indefinite number of them. What is created *ex nihilo* must be entirely present so soon as it has ceased to be wholly absent; but an object of which it is the whole being to be an embodiment of form, achieves a greater or less degree of being according to the degree of perfection with which form is realised in it. It is not without significance that the term 'real' in its modern sense passed into secular language only after the Reformation (see *O.E.D.*), *i.e.*, at the period at which the concepts of Christianity began to revolutionise the sciences of nature.

Again, the terms 'nature' and 'natural' bear a different meaning from the Greek terms *φύσις* and *φύσει*. The difference is simply that we mean by nature 'created nature', and call 'natural' what is proper to a created nature. We are generally conscious of the difference, but oblivious of its source.

pend, in regard to this element, upon the *evidence* of sensation. The reliance upon the senses for evidence, not merely for illustration, is what constitutes the empirical character peculiar to modern natural science; and the conclusion follows that only a created nature is proper object of an empirical science.

What we have attempted to show is that the method of natural science depends upon the presuppositions which are held about nature, and the presuppositions about nature in turn upon the doctrine of God. Modern natural science could begin only when the modern presuppositions about nature displaced the Greek (this was, of course, a gradual process, but its crisis occurred at the date of the Reformation); but this displacement itself was possible only when the Christian ¹ conception of God had displaced the Pagan, as the object (not merely of unreasoning belief, but) of systematic understanding. To achieve this primary displacement was the work of Medieval Theology, which thus laid the foundations both of much else in the modern world which is specifically modern, and of modern natural science.

Creative activity in God, material substance in nature, empirical methods in natural science—how closely each of these three involves the other is made clear by an examination of almost any of the great philosophies of the early modern period. A defect in the philosophical conception of God is reflected in corresponding defects both in the doctrine of nature and in the theory of natural science. Thus it is a mark of the philosophy of the Rationalist tradition that it is unable wholly ² to digest that un-Greek ele-

¹ I mean Christian, not Jewish. The Christian doctrine of God derived much from the Greek and thus included within itself, besides much from Jewish sources, much also from the very doctrine which it displaced. Cf. p. 468 *inf.*

² The qualification is to be emphasised. Modern Rationalism differs markedly from Greek Rationalism in its theories of God, nature and science, and the differences are due, as I have illustrated above, by the example of Final Causation, to its absorption of the truth of Christian doctrine. What I am maintaining here is that this absorption was still incomplete.

I must stress the fact that the limitation of the scope of this essay precludes me from doing justice to the philosophy of modern Rationalism. I have confined myself in the main to a single characteristic (the presence of an empirical element) by which modern differs from ancient natural science, and I have endeavoured to show its connection with a single Christian doctrine (that of the Creation). It is the essence of the *Empiricist* philosophy of nature to stress that element of natural objects which exceeds the grasp of the intellect, and it is easy therefore to give the impression that Empiricism alone is adequate either to exhaust the truth of Christian doctrine, or to supply the pre-suppositions of modern natural science; while modern Rationalism succeeds in doing either, if at all, only in so far

ment in the Christian theology according to which God is endowed with a *voluntary* activity in the creation of the world. Descartes' 'clear and distinct idea' of God is the idea of an infinite *thinking* substance, and although the influence of Christian dogma is strong enough in many places to modify his language, so that, having proved the existence of God, he proceeds to attribute to him activities other than theoretical, what constitutes him Rationalist is precisely that this attribution is not more than verbal. Christian dogma works in him strongly enough to modify his language, but not strongly enough to transform his thought. The God of which he has *demonstrated* the existence is a God whose whole essence is to think. His Rationalist doctrine of nature corresponds with his Rationalist doctrine of God: as he cannot conceive a voluntary activity in God, so he cannot conceive the reality of a contingent element in nature,¹ and his identification of matter with extension is the inevitable consequence of his identification of the divine activity with thought. Spinoza carried the Rationalism of Descartes to its logical conclusion. He explicitly denied those elements both in the activity of God and in the being of nature, which Descartes had failed to conceive clearly, but which ² the influence of Christian dogma had been powerful enough to prevent him from denying. It is obvious that the Rationalist doctrine of nature is incompatible in its turn with the presuppositions of empirical science. If the contingent in nature is condemned to the status of appearance, sensation can make no positive contribution to knowledge; and the only natural science possible upon the presuppositions of Spinoza's philosophy would be a science which should be, like Spinoza's 'Ethics', *more geometrico demonstrata*.

The Rationalist philosophy of nature had to be corrected if it was to be rendered consistent with the possibility of an empirical natural science. From what source could the correction come? The time had not yet arrived when it was possible to argue back from the existence of a body of natural science to the nature which it presupposed as its object. Neither could direct inspection

as it has absorbed some of the truth of Empiricism. But modern differs from ancient natural science in other respects besides the part played in it by experience, and Christianity has other doctrines relevant to a philosophy of nature, besides that of Creation. My argument does not exclude either the possibility that modern Rationalism does justice to some features of modern natural science which Empiricism ignores or even that it has absorbed the truth of some Christian doctrines which Empiricism has neglected.

¹ Cf. e.g., *Princ.*, II., viii.: "That quantity and number differ only in thought (*ratione*) from that which has quantity and is numbered".

² At least the former of which.

of the natural world afford evidence either to support or to disprove any theory of its metaphysical constitution. There was no standard by which the Rationalist doctrine of nature could be corrected, there was a standard only for the correction of the Rationalist doctrine of God. That had to be remoulded so as to conform to the Christian doctrine that God is Creator, and this remoulding carried with it as an implicit consequence such a modification of the theory of nature as would have rendered it consistent with the presuppositions of empirical science.¹

It may serve to obviate a misunderstanding, to which I have perhaps laid myself open, if I conclude with a remark on the philosophies of modern Empiricism. Berkeley, to take the example most apt to my purpose, stresses the share of sense in knowledge even to the denial of any share to reason, and he stresses the practical activity of God to such an extent that he would be forced, if he were consistent with himself, to deny to God any but a practical activity.¹ Must it not then be admitted, I imagine

¹ The essential connection which subsists between the doctrine that God has will on the one hand, and that a science of nature must be empirical on the other, may be illustrated clearly by a reference to the Leibnizian distinction between the possible and the actual. Possible is whatever is object of God's understanding and of our 'clear and distinct' (*i.e.*, intellectual, non-empirical) perception. The addition of existence to the possible Leibniz attributes to an activity distinguished from God's understanding as God's will. Existence is not intelligible; and since it is involved in the doctrine of God's will that existence is an addition to, not a diminution of, the being which belongs to the possible, the consequence cannot be avoided that intelligence is *inadequate* by itself to the knowledge of existent nature, and requires to be supplemented by sensation: *i.e.*, that an empirical element is necessary to natural science.

Conversely the rationalist doctrine that sense is only defect of understanding may be seen to be incompatible with the attribution of will to God. According to this doctrine the sensible *is* the intelligible imperfectly known; *i.e.*, it derives its sensible character from the imperfection of human perception, and therefore not from an activity of God.

Leibniz maintains a rationalist epistemology side by side with a voluntarist theology, in spite of their mutual incompatibility. Nothing short of the authority of Christianity could have prevailed upon him to admit the latter doctrine into his philosophy in the teeth of the opposition of the former. If he had but attached yet more weight to this authority, it would have led him to reform his rationalist presuppositions into consistency with his theology, and *thereby* into consistency with the procedure of empirical science.

¹ This implication of Berkeley's philosophy is clearly brought out in Mr. J. D. Mabbott's admirable article "The Place of God in Berkeley's Philosophy", in the *Journal of Philosophical Studies*, January, 1931.

It is significant that Berkeley, like Descartes, is preserved from a consistency of error principally by the necessity of conforming to Christian

the objection, that Berkeley's philosophy has *wholly* assimilated the truth of the doctrine of Creation? And yet Berkeley's philosophy is incompatible with the belief in a material substance, and signally fails to justify the presuppositions of the modern science of nature. How is this to be reconciled with the thesis of an intimate connection between the doctrine of creation and the presuppositions of empirical science?

This supposed objection rests upon the mistaken identification of the Christian doctrine of Creation with the un-Greek element in the Christian doctrine. The failure of modern Rationalism was its failure to do justice to this un-Greek element, the failure of modern Empiricism was its failure to do justice to anything else. The Christian doctrine on this, as on all other subjects, itself includes an element derived from Greek philosophy, and any doctrine from which all Greek elements are excluded is less than Christian. It is Christian to ascribe to God an activity of will, but it is not Christian to deny to God a theoretical activity or to ascribe to him a *blind* activity of will. It is a consequence of the Christian doctrine of Creation that the created world must contain an element of contingency, not that it must be nothing but contingent. It was because he drew this latter consequence, and was unable to attribute to matter the possession of any intelligible (as opposed to sensible) qualities that Berkeley was led to his denial of material substance, and to the conclusion, implicit in his philosophy if not admitted by himself, that a science of nature is not possible. Thus Berkeley falls short equally with Spinoza of expressing in his philosophy the whole of what is contained in the Christian doctrine of God. Spinoza had denied voluntary activity to God, Berkeley denies everything but voluntary activity. Similarly in their doctrines of nature, whereas Spinoza had denied contingency, Berkeley denies everything else; Spinoza's world is a nature, but is not created, Berkeley's is created but is not a nature, and so both are compelled, though for opposite reasons, to deny material substances, which can exist only in a created nature. This denial necessitates finally that both fail equally, again in opposite respects, of consistency with the presuppositions of modern natural science. Of Spinoza's world no science could be empirical, of Berkeley's no experience scientific.

doctrine in his theory of God. He does not shrink from the consequence that the science of mathematical physics is impossible, nor from outraging Common Sense by his denial of material substance, but he cannot allow himself to rest in the conclusion that the divine activity is one of blind will.