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Source: *Church History*, Vol. 30, No. 4 (Dec., 1961), pp. 433-457

Published by: [Cambridge University Press](#) on behalf of the [American Society of Church History](#)

Stable URL: <http://www.jstor.org/stable/3161219>

Accessed: 27-08-2014 09:53 UTC

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CHRISTIAN THEOLOGY AND THE NEWTONIAN SCIENCE: THE RISE OF THE CONCEPT OF THE LAWS OF NATURE

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R. G. Collingwood has suggested that the basic contrast between the Greek view of nature and what he calls the *Renaissance* view, springs from the difference between their respective analogical approaches to nature.¹ Whereas, he argues, the Greek view of nature as an intelligent organism was based on an analogy between the world of nature and the individual human being, the *Renaissance* view conceived the world analogically as a machine. Instead of being regarded as capable of ordering its own movements in a rational manner, and, it might be added, according to its immanent laws, the world, to such a view, is devoid both of intelligence and life, the movements which it exhibits are imposed from without, and "their regularity . . . due to 'laws of nature' likewise imposed from without."² Collingwood concludes, therefore, that this view presupposed both the human experience of designing and constructing machines, and the Christian idea of a creative and omnipotent God.

This is, I believe, a good way of characterizing the change in philosophical approach which made possible the development of the classical or Newtonian physical science. It is, no doubt, an historical commonplace that this change in approach entailed the rejection of the Aristotelian qualitative physics, with its apparatus of final causes and ultimate explanations of nature, and its replacement by a natural science preoccupied with quantity, efficient causes, and power over nature. But Collingwood does well to remind us of the intimate relationship between this change in approach and the rise to prominence of the concept of imposed laws of nature. For if it is difficult to locate precisely the ultimate source of this important concept (as also of the cognate juridical concept of the natural law, for both of them have their roots deep in classical and Semitic antiquity),³ historians are generally agreed that in the course of the seventeenth century the idea of the laws of nature sprang from comparative obscurity into a lasting prominence. The crucial figures in the establishment of this prominence seem to have been Descartes—perhaps the first of the important scientific thinkers to have been quite explicit on the matter,⁴ Robert Boyle (1627-91), who has been described as "the most influential publicist of the mechanical philosophy in England,"⁵ and Newton, whose writings assured it a prominent place in

the scientific language and thought of the West. The question has been raised, therefore, as to why, after centuries of theological currency, this concept attained during the course of the seventeenth century a position of such importance in the physical sciences. Only two monographs have, in the past, been addressed to this problem. The first of these was written in 1942 by Edgar Zilsel⁶ (who was also the first, to my knowledge, to formulate the problem), and the second, in 1950, by Joseph Needham,⁷ who was, however, primarily concerned with explaining the absence of a parallel concept in Chinese thought. Both Zilsel and Needham suggest a solution based on arguments drawn from historical changes in the structure of society, but neither of them can fully resolve the manifest difficulties which such arguments themselves entail. In the pages which follow, therefore, it will be my purpose, in the first place, to take a look at this solution and at its attendant difficulties; secondly, to propose a very different but, I believe, less unsatisfactory solution to the problem; and, finally, briefly to assess the significance of this new solution.

I

Zilsel is careful to insist that our problem cannot be regarded as being identical with the whole vast problem of the rise of the modern experimental science, for, as he correctly points out (p. 276), it did not necessarily follow that the mechanical regularities detected in nature should eventually be interpreted as divine laws. The fact that they were so interpreted was, in his opinion, the outcome of concomitant social developments.

He starts out with the assumption that the idea of the reign of God over the world resulted from "a comparison of nature and state," from a transfer into the divine realm of men's conceptions of earthly kings and their reigns, and to this he adds the related assumption that the Stoic doctrine of the universal natural law is correlated with the rise of the great monarchies after Alexander the Great. This being granted, it seems equally reasonable to relate the rise of the concept of the laws of nature in the sixteenth and seventeenth centuries to the decline of feudalism, the beginnings of capitalism, and the appearance of royal absolutism. Thus "it is no mere chance that the Cartesian idea of God as the legislator of the universe developed only forty years after Jean Bodin's theory of sovereignty."⁸

This explanation—which Needham believes "must surely be in principle the right one"⁹—entails, however, manifest difficulties. Even if the dubious verifiability of the initial assumption is allowed to go unquestioned (and it should not), two formidable objections may be raised. In the first place, such an hypothesis, as Needham perforce admits, "brings us face to face with the paradox that in China, where

'imperial absolutism' covered an even longer period" than in the West, we hardly meet at all with the idea of the laws of nature.¹⁰ And, in the second place, it is predicated upon a failure to distinguish between the disparate metaphysical assumptions underlying the Stoic and related views of the natural law on the one hand, and the seventeenth century concept of the laws of nature on the other, assumptions basic to the philosophic traditions from which these sprang. The distinction in question may be said to be vital to the solution of our problem and it merits close attention. It was most clearly drawn by A. N. Whitehead who, in his *Adventures of Ideas*,¹¹ pointed out the crucial contrast between laws of nature conceived as imposed upon the universe and natural law perceived as immanent in the structure of reality itself. Whitehead was, it is true, concerned with analyzing cosmological assumptions, but the doctrine is as valid and relevant in the juridical and ethical sphere as it is in the scientific.¹²

The theory of law as immanent, he argues, involves the assumption that things are interdependent in such a way that when we know the nature of things we also know their mutual relations with one another. "Some partial identity of pattern in the various characters of natural things issues in some partial identity of pattern in the mutual relations of these things."¹³ The laws of nature are the formulation of these identities of pattern. Thus it could be adduced as a law of nature that animals unite to produce offspring, or that stones released in mid-air strive to reach the ground. This view of the laws of nature involves, he concludes, "some doctrine of Internal Relations," some notion that the characters of things are the outcome of their interconnections, and the interconnections of things the outcome of their characters.¹⁴

The doctrine of imposed law, on the other hand, adopts the alternative metaphysical theory of external relations. Individual existents are regarded as the ultimate constituents of nature, and these ultimate constituents are conceived to possess no inherent connections one with another, but to be comprehensive each in complete isolation from the rest. The relations into which they enter are imposed on them from without, and these imposed behavior patterns are the laws of nature. It follows, therefore, that these laws cannot be discovered by a scrutiny of the characters of the related things, nor, conversely, can the nature of the related things be deduced from the laws governing their relations.

With this distinction clearly in mind it would be revealing to glance back at the ideas of natural law and laws of nature current in the long centuries before the Scientific Revolution. Immanent law would be found to be typified by Stoic—perhaps even generally by Greek views.

These conceived the material world to be impregnated with reason, and regarded natural law as universally valid and inherent in the very structure of things—so much so, indeed, that the Stoics could regard it as including not only the universal practice of men, in all times and in every country, but also the movements of the heavenly bodies and the habits of animals.¹⁵ Imposed law, on the other hand, would find its best illustration in Semitic, and, in particular, in Jewish monotheism. For the God of the Old Testament gave to Moses the Ten Commandments and “to the sea his law, that the waters should not pass his commandment.”¹⁶ And the two views would be found united in the Christian view, which was, according to Whitehead, “a compromise between the immanence of law and imposed law due to the Platonism of Christianity”¹⁷—a statement which is certainly true, to a very considerable degree, of medieval thought. In this, as in so many other matters, it reflects an amalgamation of Semitic and Hellenic elements. This somewhat uneasy compromise is evident in Aquinas. His God is, admittedly, a Christian God, omnipotent and transcendent, but his eternal law, which orders to their appointed ends all created things, irrational as well as rational, is undoubtedly immanent in the universe.¹⁸ Thus although God is not thought of as being immanent in the world, it should be noted that the eternal law finds its ultimate foundation in the intellect, and, therefore, in the very Being of God, so that Aquinas can at one point say that the eternal law is nothing other than God.¹⁹

This quasi-immanent view of natural law continued to flourish in the seventeenth century, finding clear if modified expression in the mature position of Grotius,²⁰ but it did not recommend itself to the scientific *virtuosi*. Collingwood, it may be remembered, was careful to describe the “laws of nature” to which the *virtuosi* attributed the regularity of the movements of the universe, as having been “imposed” upon the universe “from without” by an omnipotent Creator—God.²¹ Thus Descartes could speak not of a natural law immanent in the structure of the universe, but of “the laws which God . . . put into nature,”²² and if Newton himself was not quite as explicit, it was, no doubt, because he felt it too obvious a point to mention.²³ In the very first sentence of his Preface to the *Mathematical Principles of Natural Philosophy* he tell us that the modern investigators of nature, “omitting the substantial forms and the occult qualities [of the ancients], have undertaken to explain the phenomena of nature by mathematical laws.”²⁴ And there can be no question of these laws being intrinsic to the nature of things. No amount of study of bodies at rest will tell us anything about their possible motion, for motion is not the outcome of some “occult quality,” or the realizing of some hidden potentiality, but merely the effect of “forces impressed.”²⁵ New-

ton himself, therefore, can tell us in the *Optics* that God could “*vary the laws of nature*,”²⁶ and Roger Cotes in his Preface to the second edition of the *Principles* (which he wrote presumably with Newton’s approval) is quite clear about the imposed character of the laws of nature. “The true business of natural philosophy,” he tells us,

is . . . to inquire after those laws on which the Great Creator actually chose to found this most beautiful Frame of the World, not those by which he might have done the same, had he pleased. . . . Without all doubt this world . . . could arise from nothing but the perfectly free Will of God directing and presiding over all. From this Fountain it is that those laws, which we call the laws of Nature, have flowed, in which there appear many traces indeed of the most wise contrivance but not the least shadow of necessity.²⁷

There is clearly, then, a sharp dichotomy between Stoic and related views of the natural law as immanent in the world, and the view, characteristic of the seventeenth century *virtuosi*, that the laws of nature were imposed upon the world from the outside by the decree of the omnipotent God who created it. And the failure both of Zilsel and of Needham to perceive this cleavage does much to vitiate the solution which they give to the problem they raise. For, once this distinction is made, Zilsel’s ascription of the rise of Stoic ideas of natural law to the pervasive influence of a growing royal absolutism ceases to be obvious.²⁸ Similarly, it becomes necessary for him to offer some explanation for the fact that Grotius, living in an age of growing royal absolutism, rejected the complementary view of natural law as imposed by a divine sovereign, in order to embrace the more traditional but less easily reconcilable theory. But what is in fact required is a redefinition of the very problem itself. Needham asked “why, after so many centuries as a theological commonplace in European civilization, the idea of the laws of nature attained a position of such importance in the sixteenth and seventeenth centuries?”²⁹ But this question reveals a misunderstanding of the problem and one which, in effect, closes the way to its solution. For, as we have seen, it is important to realize that it was one particular theory—the theory of the *imposed* laws of nature which has “so much in common with Old Testament ideas”—which the works of the *virtuosi* (and especially of Newton) made a commonplace of scientific and popular thinking. In the light, therefore, of considerations such as these, I would suggest that the real problem is this: why, after so many centuries of almost total submersion in Greek ideas of immanent law, did the Semitic³⁰ concept of imposed laws of nature burst into prominence in seventeenth century scientific thought? It is this question that I propose to answer.

II

Even if it were possible to ignore the damaging imprecision with which Zilsel and Needham formulate the question, there would still be one simple but telling argument against the sociological approach which they adopt—that such an approach is unnecessary. For when Descartes spoke of God as putting laws into nature, it would seem more probable *a priori* that he was drawing on a theological rather than a political tradition. This probability is heightened by the fact that he was, after all, a devout Christian whose religion was so closely connected with his scientific thinking that Robert Boyle could comment to the effect that atheism “would subvert the very foundation of those tenets of mechanical philosophy that are particularly his.”³¹

In order, however, to identify this tradition, it is necessary, first of all, to resist the temptation which still endures among historians to speak of “*the* medieval view of things” or “*the* medieval view of the world.”³² For even if we forget about the uncertainties and ambiguities which persisted in the natural law thinking of the canon and civil lawyers of the Middle Ages and concentrate upon the theologians alone, we will find that their views about natural law were by no means uniform. Side by side with that *realist* view of quasi-immanent natural law so well expressed by Aquinas, there had developed, from the late thirteenth century onwards, a tradition which conceived law as imposed upon the world by the divine will.³³ This was the beginning of that fruitful stream of *voluntarist* natural law thinking, which, although it made its way with profound effect into the ethical, political and scientific thought of the modern world, has attracted less than its due share of attention from the historians of these subjects. The history of this tradition of thought remains, therefore, to be written, and the following outline is proffered as nothing more than a rough sketch.

The year 1277 may be suggested as the overt starting point of the new tradition. It was in that year that Etienne Tempier, Bishop of Paris, and Robert Kilwardby, Archbishop of Canterbury, formally condemned, as contrary to the Christian faith, a host of philosophical propositions, including some put forward by Aquinas.³⁴ Behind these condemnations lay the fear, widespread also among the more orthodox Arab and Jewish thinkers, that the metaphysical necessitarianism of Aristotle and his Arabic commentators, Avicenna (980-1037) and Averroës (1128-1198), endangered the freedom and omnipotence of the Semitic and Christian God. The honeymoon of philosophy and theology, as Gilson puts it, was over. The condemnations marked the formal beginning of the theological reaction that was to vindicate the freedom and omnipotence of God at the expense of the

ultimate intelligibility of the world.³⁵ The compromise which had united a transcendent Semitic Creator-God with an intelligible Hellenistic world was abrogated, and with it any idea of natural law as immanent. For the quasi-immanentism characteristic of Aquinas' doctrine of natural law—a compromise position which, it will be remembered, Whitehead had ascribed to “the Platonism of Christianity”—did, in fact, involve the attempt to Christianize the Platonic doctrine of Eternal Forms or Ideas by locating them in the divine mind as exemplars in accordance with which God created the world and ruled it. And thus Aquinas could define the Eternal law as “nothing other than the idea of the divine wisdom in so far as it directs all acts and movements.”³⁶

This quasi-immanentism was hedged around with cautious qualifications, but the condemnations of 1277 made it clear that these qualifications had not been cautious enough. Subsequent theologians had to do their thinking in the full glare of this persuasive clarification, and it is not surprising that many of them tended to set God over against the world which he had created, and to regard the order of this world as deriving, not from the realization of the divine ideas, but rather from the peremptory mandate of an autonomous divine will. This reaction was already manifest in the primacy over the divine intellect which Duns Scotus (ca. 1270-1308) accorded to the divine will,³⁷ and it attained full stature in the ethical voluntarism of William of Ockham.

What Ockham did was to ground natural law, and, indeed, all ethical values, on the will of God. Natural law, therefore, ceased to be “a dictate of reason as to what is right grounded in the being of God but unalterable even by him,” and became “a divine command . . . right and binding merely because God was the lawgiver.”³⁸ Thus “evil is nothing other than the doing of something opposite to that which one is obliged to do.”³⁹ Hate of God, adultery, robbery—all such vices—could be stripped of their evil and rendered meritorious “if they were to agree with the divine precept.”⁴⁰ For “God is obliged to the causing of no act.”⁴¹ It is true that, of his ordained power (*potentia ordinata*), God condescends to work within the framework of the moral law which he has already established, and to which right reason is the infallible guide,⁴² but of his absolute power (*potentia absoluta*), by which he can do anything that does not involve a manifest contradiction, he could abrogate that order entirely.⁴³ The dictates of natural law, the infallibility of right reason, the very fact that it is virtuous to act in accordance with right reason—all of these amount to nothing more than inscrutable manifestations of divine omnipotence.⁴⁴

Such a theory of natural law falls, clearly enough, into Whitehead's category of *imposed law*. And this was the theory that was propagated by the followers of the *via moderna*, the nominalist philosophers who became so strong in the later Middle Ages, especially at Oxford and Paris. Notable among these were Pierre d'Ailly (1350-1420) and Jean Gerson (1363-1429), the renowned ecclesiastical statesmen and Chancellors of the University of Paris whose works were widely read in the fifteenth and sixteenth centuries.⁴⁵ And to their names may be added, among others, that of Robert Holcot (d. 1349),⁴⁶ as well as those of Gabriel Biel (d. 1495), Jacob Almain (d. 1515), John Major (d. 1540), and Alphonse de Castro (d. 1558). The Jesuit philosopher Suarez (1548-1617) cited all of them as supporters of the voluntarist theory and it should be noted that his own natural law thinking bore the strong impress of their point of view.⁴⁷

This way of thinking was by no means limited to the scholastic philosophers. Luther was well acquainted with the works of d'Ailly and Biel and through him the theory of imposed natural law seems to have made its way into Protestant thought.⁴⁸ De Lagarde, indeed, sees in the thought of the reformers in general a reiteration of the nominalist idea of law.⁴⁹ More recent researches have shown that this is certainly true of Zwingli,⁵⁰ while in the case of Calvin, though it would be rash to ascribe the voluntarism of his ethic to nominalist influence, it remains true to say that he, too, viewed the moral law as completely dependent on the will of God, which law he equated with the testimony of the natural law implanted by God in the souls of men.⁵¹

Suarez's *Treatise on Laws*⁵² stands as evidence for the persistence into the seventeenth century of this way of thinking, as also does the *Apologia* for Jean Gerson written by the Sorbonne theologian Edmond Richer (1559-1631).⁵³ Earlier in the same century, as we have seen, Grotius had adopted a similar position in his *Commentary concerning the Law of Booty*. And a few years later, Pufendorf (1632-94)⁵⁴ and Hobbes⁵⁵ were to conceive of natural law in similar terms—Hobbes, indeed, being in a poor position, because of his mechanistic view of the universe, to adopt any view of natural law other than as imposed by God. The growing lack of interest in the divine origin of the natural law and the characteristic imprecision of eighteenth-century thinking on the subject do much to obscure the ultimate fate of the tradition, though at the turn of the century the Puritan divine Samuel Willard (1640-1707) was teaching in his New England congregation that the equity of God's law "is founded on the good will and pleasure of God," and that that law is revealed to man not only by the Scriptures but also by "the light of nature . . . so that men are said to do by nature the things contained in the law."⁵⁶ And, even to-

wards the end of the century, Blackstone was still speaking of the natural law which governs man as "the will of his maker."⁵⁷

It is already clear that the doctrine was by no means the monopoly of the professional theologians, or even of the thinkers of any one creed or of any one country. And if we were to extend our list of those who subscribed to this theory of imposed natural law, we would have to include (among others) not only the English Puritan divines John Preston (1587-1628) and William Ames (1576-1633), or their New England colleague John Norton (1606-1663),⁵⁸ not only the Anglican theologian Robert Sanderson (1587-1663) and the early Cambridge Platonist, Nathaniel Culverwell (*ca.* 1615-*ca.* 1651)⁵⁹ but also John Locke, and at least one other Fellow of the Royal Society—the botanist Nehemiah Grew (1641-1712).⁶⁰

When Descartes spoke of God's having imposed laws upon nature, all he really had to do, therefore, was to transfer from the moral order into the realm of natural philosophy the well-established theological doctrine of an omnipotent Legislator-God, whose sovereign will lies at the very heart, not only of the divine laws revealed in the Scriptures, but also of that natural law to which right reason is man's unswerving guide. There can be little doubt that he was familiar with this tradition—the less so, indeed, in that Ralph Cudworth (1617-88), one of the Cambridge Platonists and an indefatigable opponent of the voluntarist ethic, could identify Descartes as one of the principal advocates of this pernicious doctrine, which, he complained, was dear to those who "think nothing so essential to the Deity as uncontrollable power and arbitrary will."⁶¹ But Cudworth's perceptive remarks can be more profitably employed in exposing the redundancy even of speculations as cautious as these. For he linked the renewed popularity of the voluntarist theory with the revival of "the physiological hypotheses of Democritus and Epicurus," and with their successful application "to the solving of some of the phenomena of the visible world."⁶² And this suggestion, however debatable, may serve to remind us that natural law theories are by no means insulated from the main body of philosophy, but reflect or presuppose congruent concepts of nature.⁶³ It is to be expected, therefore, that changes in natural law theories will entail, or be entailed by, concomitant changes in concepts of nature, and this expectation will be fulfilled if, keeping the point in mind, we glance back at the contrasting views of Aquinas and Ockham.

The natural law, according to Aquinas, is nothing other than the Eternal Law in so far as it concerns man and is apprehended by him, and the Eternal Law itself is the divine reason in which all things, irrational as well as rational, participate—in that "they derive from

it certain inclinations to those actions and aims which are proper to them.”⁶⁴ This law is certainly conceived as being in some sense immanent in the world, and it is hardly surprising, therefore, that this concept of nature, impregnated as it is with those “substantial forms and occult qualities” which were to be anathema to the scientists of the seventeenth century, is at least cognate to that organic view which Collingwood spoke of as “the Greek idea of nature.” Nor is it surprising that Ockham’s abandonment of the theory of natural law as immanent went hand in hand with something of a revision of this idea of nature.

Gilson has spoken of Ockham’s thought as being a post-1277 theology “in a more than chronological sense,” and as being dominated “by the first words of the Christian creed: I believe in one God, the Father Almighty.” These claims are by no mean exaggerated.⁶⁵ Ockham regarded the divine liberty as compromised not only by the *realist* connection of the natural moral law with the doctrine of the divine ideas but also by the very doctrine of the divine ideas itself—which he further condemned, at least in its traditional form, as dissolving into an un-Christian multiplicity the perfect unity of God. Not only the moral law but the whole of Creation, he insisted, must be radically contingent upon the undetermined decisions of the divine will. And, believing this, he had little choice but to abandon the traditional doctrine of the divine ideas, and to dismiss with it the whole realist metaphysic of essences upon which it depended.

Such a basic shift in philosophical perspective could not but determine the lineaments of his philosophy of nature. Ockham’s universe can hardly be regarded as in any sense organic. It is one in which there are no necessary intermediaries between, on the one hand, an infinitely free and omnipotent God, and, on the other, the things which he has created and which are utterly contingent upon him. Hence the dismissal of any necessary connections in nature between distinct things, even between cause and effect.⁶⁶ Hence, too, the belief that we can in no way deduce the order of the world by any *a priori* reasoning, for, being completely dependent upon the divine choice, it corresponds to no necessity and can be discovered only by an examination of what is *de facto*.⁶⁷ Thus, from Ockham’s fundamental insistence upon the omnipotence and freedom of God follows, not only his ethical and legal voluntarism, but also his empiricism.

Because he held to these views it has often been concluded that there is no point in looking for any plan or system in an Ockhamist universe, just as in the realm of his ethical teaching, historians have been apt to argue that there is no place for any true concept of natural law.⁶⁸ But to draw either of these conclusions is to suppose that Ock-

ham conceived of God as a wholly capricious Being, and to overlook a distinction which he drew concerning the modes of the divine activity—a crucial distinction, the very existence of which invalidates such a supposition. For Ockham reasoned that although God could, of his *absolute* power, order the opposites of the acts which he has in fact forbidden, nevertheless, by his *ordained* power, he has actually established a moral order, within the framework of which the natural law is absolute and immutable. This was no mere *ad hoc* argument relevant only to the realm of ethics, for Ockham regarded the distinction as applicable to all operations of the divine will and it occupies, indeed, a fundamental position in his thought. He believed that although God's absolute power can suffer no limitation, it normally expresses itself in accordance with the order which has actually been ordained—whether it be the order of grace or of nature. God has made certain promises to us in the Scriptures, and, as Christians, we must believe that he will fulfill them. Similarly, whether we are Christians or not, we can perceive in the regularities of nature certain constant rules and we can safely assume that God will *normally* operate within the limits they impose. But one big reservation is assumed in all this, and Ockham draws attention to it by the use of such qualifications as *given the divine order* and *in the present order*.⁶⁹ It is true that God will normally act in accordance with the supernatural or natural order which he has ordained but it must not be forgotten that, of his absolute power, he could always abrogate the present moral and natural economy, or momentarily transcend it, as he does in the case of miracles. It is, for example, a matter of everyday experience that water dampens and fire burns, but by the absolute power of God these effects need not necessarily proceed from their causes—and to illustrate the point, Ockham cites the fate of Daniel's three companions, Shadrach, Mishach and Abednego, whom King Nebuchadnezzar threw into the fiery furnace but who emerged unscathed.⁷⁰

It would be incorrect to assume, therefore, that the philosophical revolution resulting from the Ockhamist preoccupation with the omnipotence of God necessarily entailed an incoherent universe arbitrarily peopled with unpredictable events. It is true that Ockham's rejection of any necessary connections in nature, coupled, as it was, with his denial of the reality of final causes and his concentration upon efficient causality,⁷¹ eliminated the possibility of any organic view of nature comparable with that of Aquinas, but his alternative is not, as is often suggested, a systemless chaos, but rather something that looks not unlike the universe pictured by the scientists of the seventeenth century. Crombie, indeed, has pointed out that Ockham's position was cognate to that of the seventeenth century *occasionalists*, the most famous of whom was Malebranche,—thinkers who believed that “in

his activities God usually followed fixed rules, so it was possible for natural philosophers to formulate general scientific laws.⁷² And although I know of no instances in which Ockham himself uses with a clearly scientific connotation the precise expressions *laws of nature* or *natural law*, nevertheless, in common with other nominalists, he does make use of the legal metaphor to indicate the fixed order according to which God, of his ordained power, acts. Thus, he himself uses the expression *by the common law* as synonymous with *in the present order* or *given the divine order*,⁷³ while, in the same way, Pierre d'Ailly, later on in the fourteenth century, employs among others such revealing phrases as *by the common course of nature*, *by the common laws and naturally*, and *naturally or by the ordained law*.⁷⁴ And it is, perhaps, hardly surprising that d'Ailly goes a little further, and not only speaks of God as having ordained "a natural law" in the things of this world, but even admits the relevance to the universe of that very clock analogy which was to be vulgarised in the seventeenth century by Robert Boyle and which was to become a cliché of eighteenth-century Deist theology.⁷⁵

What we are seeing here is something which—given a realization of the existence of internal connections between theories of natural law and views of nature—was only to be expected. It is the emergence of the conception of divinely imposed laws of nature in the writings of those very thinkers who had adopted and popularized the cognate view of a juridical natural law as grounded, not in the nature of things, but in the will of a sovereign Deity. It is no doubt possible to exaggerate the extent to which the views of these late medieval thinkers coincide on this point with those held later on by the scientists of the seventeenth century, but it is not easy to do so. To establish this contention, it is requisite only to recall to mind those ideas of Newton which we have already examined⁷⁶—indeed Newton was by no means of the most explicit of the *virtuosi* on this subject. We do not even have to go beyond the circle of his colleagues in the Royal Society to hear Walter Charleton (1619-1707) speaking of God as the "Rector General or President Paramount" of the universe, "by whose sovereign dictates all subordinate ministers are set on work, in order to the execution of his pleasure, and in their operations vary not a hairsbreadth from the rules prescribed by his will"—which rules he describes elsewhere as "the severe laws of Nature" with which God has "bound up the hands of his Creatures, limited their activities, and punctually consigned them their several provinces."⁷⁷ Nor should we fail to note, in the same treatise, his rejection of the "Platonic" and "Stoic" idea of Fate in so far as it

blasphemously invades the Cardinal Praerogative of Divinity, Omnipotence, by denying him [God] a reserved power, of infringing, or altering

any one of those laws which he himself ordained and enacted, and chaining up his armes with adamantyne fetters of Destiny.⁷⁸

An onslaught which would have been worthy of the most positively “post-1277” theologian!

And if we turn to Robert Boyle, who, as a philosopher of science, was perhaps the most influential of all the English *virtuosi* before Newton, we will not only find him speaking of God as “the supreme and absolute lord” of creation who “established those rules of motion, and that order among things corporeal which we are wont to call the laws of nature,”⁷⁹ not only pointing out that “the laws of motion, without which *the present state and course of things* could not be maintained, did not necessarily spring from the nature of matter, but depended upon the will of the divine author of things,”⁸⁰ but also insisting that this “present state and course of things”—which he also refers to as *the ordinary course of things* and as *the instituted order*⁸¹—can be abrogated by God, who, being omnipotent, can “do whatever involves no contradiction.”⁸² Thus he can conclude that “though some modern philosophers have made ingenious attempts to explain the nature of things corporeal, yet their explications generally suppose the present fabric of the world, and the laws of motion that are settled in it.”⁸³

This remarkable coincidence between the views of fourteenth-century theologians and seventeenth-century scientists can only serve to confirm what we have already suggested—that they were linked by an enduring theological tradition. In so far as this tradition manifested itself in the *voluntarist* conception of the natural law, it had, as we have seen, a continuous history at least from the late thirteenth century onwards. If it is less easy to establish a similar explicit continuity in the case of the scientific conception of divinely imposed laws of nature, it is by no means impossible, for the two ideas went hand in hand. Thus, among the ranks of the early Reformers we find Zwingli (1484-1531) speaking of God as having brought the world under “law and order,” or defining “naturally” as “in accordance with the order constituted at the beginning,” and Melancthon saying that though “the whole machine of the world” serves “perpetual laws,” and though philosophers speak of the heavenly bodies as being moved “necessarily,” nevertheless, this physical necessity is to be understood only “of the order now instituted,” for God is “a most free agent, not, as the Stoics used to teach, bound by secondary causes.”⁸⁴ Similarly, among the English Puritans, as early as 1585, we find Dudley Fenner (1558?-87) speaking of God’s *ordinary* government of things as being that which is in accordance with “the common law” which he has imposed upon nature,⁸⁵ while the Federal theologians, from William Ames in England at the beginning of the seventeenth cen-

tury to Samuel Willard in Boston at the end, speak with striking uniformity of God's ordinary providence as being that mode of government "whereby God observeth that order in things which was appointed from the beginning," and of "that order in natural things" as being "the law of nature common to all things."⁸⁶ Nor do they fail to point out that God is "a great Monarch, who . . . holds the Creature in full subordination to His absolute pleasure," and is by no means bound to observe the "constituted order of nature," but by his extraordinary providence (as in the case of miracles) can produce effects which "outdo the laws of nature, or do invert the common order and course of things."⁸⁷

As is only to be expected, the continuity is (if possible) even more explicit in the works of Suarez who, though he regarded as merely metaphorical the application of the expression "law" to the non-human world, frequently speaks, nevertheless, of laws of nature in the scientific sense.⁸⁸ This involves no contradiction, for although, as he has said, "things lacking reason are, properly speaking, capable neither of law nor of obedience," he regards this law, however, as that which *God binds himself* to follow in all those actions which he does according to his ordinary or ordained power. Thus he can define the ordinary power of God as that power by which "he operates in accordance with the common laws which he has established in the universe," and can add that when we say that God cannot do something by his ordained power, we mean that he cannot do something "according to the ordinary law which he has imposed upon himself."⁸⁹ And Suarez points in the general direction of at least one Fellow of the Royal Society—John Locke, who, in common with Sanderson, not only speaks of God as having imposed his will upon nature in the form of constant laws, but also assumes this to be an idea so widely accepted that he uses it as a justification for suggesting that man, in his moral life too, is subject to a natural law.⁹⁰

Thus the idea of laws of nature imposed by God upon the world was undoubtedly common coinage in the sixteenth and seventeenth centuries, even before Descartes, Boyle and Newton made it a commonplace of scientific thinking, and what we are suggesting here is simply that it was so widespread precisely because it was the expression of a tradition in natural theology which dated back well beyond the late thirteenth century but which had been prominent since that time and which was little affected and perhaps even strengthened by the upheaval of the Reformation. It is true that the innovations of the Reformers, though they were concentrated upon other areas of theology, have served nevertheless to obscure the lack of change in natural theology, and some scepticism may no doubt remain about the

exact nature of this alleged continuity. In theology as in philosophy the number of possible positions is, after all, a strictly limited one. The occurrence in the course of history of parallel but totally unrelated doctrinal positions should, therefore, be the occasion of little surprise. Nor, from the point of view of the history of science should we forget Crombie's warning that "the problem of the relation of seventeenth century science to medieval science still remains a *questio disputata*."⁹¹

The evidence is not lacking, however, to eliminate any lingering doubts about the real continuity of this tradition. We should not allow ourselves to be misled by the constant attacks on medieval scholastic thinking that are to be found in the writings both of the theologians and of the scientists of the seventeenth century. Such attacks seem to have been very much a matter of convention and should not be taken as proof that their authors regarded the works of the scholastics as worthless. Among the ranks of the scientists, Charle-ton was not unwilling publicly to acknowledge his dependence upon scholastic theological ideas, and the feeling of familiarity which a student of nominalist theology experiences upon reading, for example, William Ames's *Marrow of Sacred Divinity* is by no means misleading.⁹² Moreover, John Norton, the New England Puritan divine could comment, in 1654, that the scholastic thinkers, because of their pre-eminence in rational disputation

of late years have crept (for a time) into more credit among schools, than the most judicious and orthodox of our best new writers (Luther, Calvin, Martyr, Bucer and the rest), and their books were much more vendible and at a far greater price.⁹³

More precisely, in the specific area which is our present concern, the nominalist origin of the voluntarist tradition of natural law thinking was not unknown, even in the seventeenth century, for Ralph Cudworth, the most learned of those who were opposed to this view, while he directs his barbs against Hobbes and the Calvinist theologians, can tell us, nevertheless, that:

though the ancient fathers of the Christian Church were very abhorrent from this doctrine, . . . yet it crept up afterward in the scholastic age, Ockham being among the first that maintained: ". . . That there is no act evil but as it was prohibited by God, and which cannot be made good if it be commanded by God." . . . Herein Petrus Alliacus [Pierre d'Ailly] and Andreas de Novo Castro, with others quickly followed him.⁹⁴

But in the last analysis, it is unnecessary even to rely upon indirect evidence of this type. For conclusive evidence of the explicit continuity of the tradition in question appears in the remarkable endurance of that characteristic distinction between the *absolute* and *ordained* or *ordinary* powers of God which we have already had occasion to examine. This distinction crops up in the works of nearly

all of those writers whom we have cited as holding either to a voluntarist theory of natural law, or to a conception of divinely imposed laws of nature, or—as in many cases—to both.⁹⁵ And this is hardly surprising, for in order to realize the extent to which this distinction is bound up with the idea of divinely imposed laws of nature, it is sufficient merely to recall Suarez's definition of the ordained or ordinary power of God as that power by which "he operates in accordance with the common law which he has established in the universe"—a law which, in fact, reflects a self-imposed commitment on the part of God to rule the universe along the lines of the natural order which he himself has established in it. The history of this distinction, which played a crucial role in the thought of Ockham, and of such late medieval theologians as d'Ailly, Major,⁹⁶ Durandus of St. Pourcain (d. 1332), Robert Holcot, Thomas Buckingham (d. 1351), and Adam of Woodham (d. 1358),⁹⁷ can be traced down at least as far as the sermons delivered at Boston by Samuel Willard at the end of the seventeenth century and the beginning of the eighteenth.⁹⁸

Perry Miller has stressed the importance of the idea in Puritan theology,⁹⁹ where, indeed, it generated another but closely related distinction between the *ordinary* and *extraordinary* Providence of God. This distinction, prominent in the thought of Ames, Thomas Shepard (1605-49), John Morton and Increase Mather,¹⁰⁰ also figures significantly in the writings of John Wilkins, Charleton and Boyle—all three of them luminaries of the Royal Society.¹⁰¹ Thus Boyle can note that miracles involve departures from God's "ordinary and general concurrence," and can describe them as "extraordinary and supernatural interpositions of divine providence," by which God may be seen "to over-rule or controul the established course of things in the world by his own omnipotent hand."¹⁰² Similarly, he can argue that:

if we consider God as the author of the universe, and the free establisher of the laws of motion, whose general concurrence is necessary to the conservation and efficacy of every particular physical agent, we cannot but acknowledge, that, by withholding his concurrence, or changing these laws of motion which depend perfectly upon his will, he may invalidate most, if not all the axioms and theorems of natural philosophy: *these supposing the course of nature*. . . . It is a rule in natural philosophy that *causae necessariae semper agunt quantum possunt*: but it will not follow from thence, that the fire must necessarily burn Daniel's three companions or their clothes that were cast by the Babylonian King's command into the midst of a burning fiery furnace, when the author of nature was pleased to withdraw his concurrence to the operation of the flames, or supernaturally to defend against them the bodies that were exposed to them. . . . Agreeably to this let me observe to you that, though it be unreasonable to believe a miraculous effect when attributed only to a mere physical agent, yet the same thing may reasonably be believed when

ascribed to God, or to agents assisted with his absolute or supernatural power.¹⁰³

It will be remembered that this example of the miraculous survival of Daniel's three companions, Shadrach, Meshach and Abednego, after they had been thrown into the Babylonian furnace, was the very example which Ockham himself had used to illustrate much the same point, and the recurrence of this particular Biblical illustration may serve as the final and clinching evidence for the validity of our thesis that the scientific idea of divinely imposed laws of nature had its origin in a living theological tradition which went back to the last years of the thirteenth century. For this very Biblical example, used to illustrate this same point concerning the power of God, is to be found, not only here and in two other works of Boyle, but also in the works of Luther, Melancthon, Suarez, Perkins, Preston, Ames, Shepard, Norton, Increase Mather and Willard¹⁰⁴—that is to say, in the works of a high percentage of those very authors whom we have seen to subscribe to the voluntarist theory of natural law and of the laws of nature.¹⁰⁵

In the light, therefore, of these considerations, there can remain little room for doubt either that the voluntarist conception of natural law attained a wide currency in the sixteenth and seventeenth centuries, or that it was directly descended from the similar theory hammered out by the nominalist theologians in the years after the condemnations of 1277. It was conceived both with a juristic and a scientific sense,¹⁰⁶ and, being the result of a crucial shift in the direction of the "simplified view of nature" which was later to be adopted by Galileo, Descartes and Newton, was eminently compatible with this view. If, therefore, we ask ourselves why, in the seventeenth century, the Semitic concept of divinely imposed laws of nature burst into scientific prominence, it is unnecessary, and, indeed, misleading to postulate the influence of social and political analogies—for the influence was, if anything, exerted in the opposite direction. When Descartes spoke of a God who put laws into nature, he did not have to create such a God. He did not, as Zilsel suggests, have to apotheosize Bodin's sovereign. He did not even have to transfer the idea from the juridical and moral realm into the world of natural causation. All he had to do was to employ the theological conception of a legislating God whose most striking attribute was his irresistible power, a conception which had its principal source in the Old Testament, which was clearly formulated and fully elaborated by his philosophizing predecessors of the later Middle Ages, and which lay at the heart of the natural theology, not only of many of the Catholic theologians of his own day, but also of perhaps the majority of their Protestant counterparts.

IV

Some years ago, E. A. Burtt noticed that "Newton, in common with the whole voluntaristic British tradition in medieval and modern philosophy, tended to subordinate, in God, the intellect to the will,"¹⁰⁷ and in the light of the above findings, it must now seem that when he did so he had noticed something of far greater significance than an interesting similarity. It now remains, briefly and in conclusion, to attempt to assess the fundamental significance of these findings.

When scientists today speak of the laws of nature, no element of command attaches to the expression. It is regarded, perhaps most often, as "indicating statistical regularities, valid only in given times and places."¹⁰⁸ On this ground it might, perhaps, be argued that the historical application of the legal metaphor to mechanical regularities, experimentally established and mathematically formulated, was productive less of scientific progress than of a terminological inexactitude prolific in misconceptions. Such an assertion would ignore, however, the theological assumptions which we have seen the legal metaphor to involve and because of which it was adopted.

As long ago as 1883 Ernst Mach pointed out that an undue preoccupation with "the conflict between science and theology" could be extremely misleading because, in his considered opinion, many of the conceptions "which completely dominate modern physics" actually "arose under the influence of theological ideas."¹⁰⁹ Mach's warning does not seem to have attracted a great deal of notice, but in 1926 and 1945, respectively, Whitehead and Collingwood again drew attention to the importance of Christian beliefs for the development of the classical or Newtonian science. The most complete statement of this point of view, however, was made in 1934-5 by Michael Foster in two lucid and penetrating articles which, after a lapse of some years, have now begun to command the interest they so richly deserve.¹¹⁰ His general thesis, put very roughly, is this: in the first place, that the early modern philosophers, from Descartes to Leibniz, ascribed to the world of nature, in advance of the actual establishment of the modern natural science, the very character which constituted it a possible object of that science; secondly, that in so doing, they were putting forward a new theory of nature, not upon any grounds of proven expediency, but because their thinking was shaped by elements which were not of Greek origin and which consorted ill, therefore, with the Greek idea of nature; finally, that the source of these non-Greek elements must have been the Christian revelation, and in particular the Christian doctrine of creation—presupposing, as it did, the idea of an omnipotent God from whom the world did not proceed by any neces-

sary emanation, but who called it into being by the autonomous *fiat* of his will. Foster attempts to show, therefore:

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. . . .; but this displacement itself was possible only when the Christian concept of God had displaced the pagan, as the object . . . 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.¹¹¹

The arguments which he uses to establish his claim need not detain us here—suffice it to say that they are philosophical rather than historical in character. But herein, it may be suggested, lies the central significance of our own findings. For they go at least some of the way towards providing the complementary historical arguments, some of the way towards establishing that what Foster, after an examination of theological and philosophical positions, claimed *must* have been the case, *was* in fact the case. For the reappearance in the later Middle Ages of the crucial idea of imposed laws of nature, along with the view of the universe most eminently compatible with it, was the outcome of a reaction on the part of Christian theologians against the pagan necessitarianism of Greek thought. The exact significance of this becomes even more apparent if we bear in mind Needham's parallel conclusion that one of the crucial reasons for the failure of the Chinese to develop a natural science comparable with that of the West was their prior failure to produce a comparable concept of laws imposed upon nature, and that this latter failure was, in turn, the outcome of their lack of any conception of a personal, legislating Creator-God.¹¹² Speaking of the Taoist thinkers he says that "with their appreciation of the relativism and subtlety and immensity of the universe they were groping after an Einsteinian world-picture, without having laid the foundations for a Newtonian one," and that "by that path science could not develop."¹¹³ It was not that the Chinese lacked the idea of an order in the universe, but that they regarded it as an "harmonious co-operation of all beings" arising "not from the orders of a superior authority external to themselves, but from the fact that they were all parts in a hierarchy of wholes forming a cosmic pattern, and what they obeyed were the internal dictates of their own reason."¹¹⁴

Such a view of the world is not unfamiliar. It clearly has much in common, not only with the thinking of the Stoics, but also with the scholastic view as propounded by Aquinas and the *realists*. Assuming, therefore, that the abrogation of this view was one of the

metaphysical adjustments necessary for the inception of the classical or Newtonian science, I am led to propose the following general conclusion: that the prime mover in this process of adjustment was the renewed and disturbing pressure upon Greek modes of thought of the Semitic idea of an omnipotent Creator-God. So that, paradoxically, if it is possible to argue that philosophy suffered because of the condemnations of 1277, it must surely be admitted that the physical sciences, in the long run, undoubtedly gained.¹¹⁵

1. *Idea of Nature* (Oxford, 1945), pp. 3-9. As Collingwood himself admits (p. 4), "the name is not a good one, because the word 'Renaissance' is applied to an earlier phase in the history of thought... The cosmology I have now to describe... might, perhaps, be more accurately called post-Renaissance."
2. *Ibid.*, p. 5.
3. Scrutiny of the *Oxford English Dictionary* s.v. *Law* reveals two primary current meanings for the expression *natural law*. It is defined, on the one hand, as that law, prescribed by no enactment or formal compact, which is implanted by nature in the human mind, or is capable of being demonstrated by reason. On the other it is defined as referring, in "the sciences of observation," to the theoretical principles deduced from particular facts, applicable to defined groups or classes of phenomena, and expressible by the statement that particular phenomena always occur if certain conditions are present. For purposes of clarity I propose to use the term *natural law* to refer to the juristic concept, and the term *laws of nature* to indicate the scientific usage.
4. See *Discours de la Méthode, Cinquième Partie. — Oeuvres de Descartes*, ed. Jules Simon (Paris, 1841), pp. 26-27.
5. Richard S. Westfall, *Science and Religion in Seventeenth Century England* (New Haven, 1958), p. 73.
6. "The Genesis of the Concept of Physical Law" *The Philosophical Review*, LI (1942), pp. 245-79.
7. The L. T. Hobhouse Memorial Trust Lecture No. 20, delivered on 23 May, 1950 at Bedford College, London, and published under the title: *Human Law and the Laws of Nature in China and the West* (London, 1951). An expanded version bearing the same title is to be found in the *Journal of the History of Ideas*, XII (1951), pp. 3 ff., and 194 ff., and also as Section 18 of Joseph Needham and Wang Ling, *Science and Civilization in China*, II (Cambridge, 1956), pp. 518-583—to which book my references will be given.
8. "The Genesis of the Concept of Physical Law," pp. 277-279.
9. *Science and Civilization*, II, p. 542.
10. *Ibid.*, p. 543.
11. *Adventures of Ideas* (New York, 1937), pp. 142-147.
12. For an interesting attempt to apply the distinction to the juridical sphere see M. Ginsberg, "The Concept of Juridical and Scientific Law," *Politica*, IV, No. 15 (March, 1939), pp. 1 ff.
13. *Adventures of Ideas*, p. 142.
14. *Ibid.*, p. 144.
15. This pantheistic Stoic view is fundamental to the statements about natural law which are to be found in the *Corpus Juris Civilis*—see *Inst.*, I, 2, 11; *Dig.*, I, 1, 1, § 3; I, 1, 2.
16. *Prov.* viii, 19.
17. *Adventures of Ideas*, p. 133.
18. And in so far as it concerns man and is apprehended by his reason, the eternal law is called the *natural law*—*Summa Theologia*, Ia 2ae, qu. 94, art. 2 *Resp.*
19. *S.T.*, Ia 2ae, qu. 91, art. 1 *ad tertium*.
20. Thus he can argue that God himself "cannot make that which is intrinsically bad, not be bad." For "as the essence of things... by which they exist, does not depend on anything else, so also it is with the properties which necessarily follow that essence; and such a property is the evil of certain acts, when compared with the nature of a reasonable being. And therefore God himself allows himself to be judged according to this norm."—*De Jure Belli et Pacis*, Bk. I, ch. 1, § X, 5; ed. William Whewell (Cambridge, 1853), p. 12. It should be noted, however, that in his earlier *De Jure Praedae*, *Commentarius*—ed. H. G. Hamaker (The Hague, 1868)—he had taken as his point of departure the principle that the divine will is the basis of natural law (see

- ch. 2, pp. 7-9). This work was written in the winter of 1604-5 but rediscovered only in 1864 and first published in 1868.
21. *Idea of Nature*, p. 5.
 22. Cf. *supra*, n. 4.
 23. He definitely believed, as Whitehead puts it, "that the correlated modes of behaviour of the bodies forming the solar system required God for the imposition of the principles upon which all depended."—*Adventures of Ideas*, p. 144. And thus, in his first letter to Bentley, Newton could write that "the motions which the planets now have, could not spring from any natural cause alone, but were impressed by an intelligent agent."—*Opera quae exstant omnia*, ed. Samuel Horsley, IV (London, 1782), p. 431.
 24. *Philosophiae Naturalis Principia Mathematica*, Praefatio; *Opera Omnia*, II, p. ix.
 25. See *Principia*, Axiomata, Lex I; *Opera Omnia*, II, p. 13; *Principia*, Bk. 3, Schol. Gen.; *Opera Omnia*, III, p. 174.
 26. *Opera Omnia*, IV, p. 263.
 27. *Opera Omnia*, II, pp. xx and xxiii; the translation cited is that of Andrew Motte, revised by Florian Cajori (Berkeley, 1946), pp. xxvii and xxxii.
 28. As the Stoics conceived of natural law as immanent in the universe the idea of command could play no part in such a conception.
 29. *Science and Civilization in China*, II, p. 542.
 30. 'Semitic' rather than 'Judaic' because as Needham points out (p. 533) the idea was probably of Babylonian origin.
 31. *A Disquisition about the Final Causes of Natural Things. The Works of the Honourable Robert Boyle*, ed. Thomas Birch, V (London, 1772), p. 401.
 32. For an example see S. F. Mason, "Science and Religion in 17th Century England," *Past and Present*, No. 3 (1953), esp. pp. 28-30.
 33. For a comparison between the views of Aquinas and those of the followers of the voluntarist tradition, and for a discussion of the importance of this tradition in the juridical sphere, see Francis Oakley, "Medieval Theories of Natural Law: William of Ockham and the Significance of the Voluntarist Tradition," *Natural Law Forum*, VI (1961), pp. 65-83.
 34. See Etienne Gilson, *History of Christian Philosophy in the Middle Ages* (New York, 1955), pp. 405 ff.
 35. This amounted to an abandonment of any attempt to reconcile the Greek conception of a necessarily existing universe, ruled by strict necessity, with the Biblical notion of a freely created world ruled by a free and omnipotent divine will. Arab thinkers had already faced the same problem and had adopted a comparable solution. Al Ash'ari (d. 936) and his followers vindicated the Semitic notion of God by adopting an atomistic view of the world as constituted of disjointed moments of time and points of space, connected together only by the will of God and possessing, therefore, no natural necessity. They held to this position so strictly that they were driven into a thorough-going occasionalism—see L. Gardet and M.-M. Anawati, *Introduction à la théologie musulmane*, Etudes de phil. méd., XXXVII (Paris, 1948), pp. 52-66. This viewpoint was also adopted by early Jewish thinkers—see Ernest Renan, *Averroës et l'Averroïsme* (Paris, 1861), p. 106, and Isaac Husik, *A History of Medieval Jewish Philosophy* (New York, 1958), p. xli.
 36. *S.T.*, Ia 2ae, qu. 93, art. 1 *Resp.*
 37. See C. R. S. Harris, *Duns Scotus*, II (Oxford, 1927), pp. 214-217.
 38. Otto von Gierke, *Political Theories of the Middle Ages*, trans. Maitland (Cambridge, 1927), p. 173, n. 256.
 39. *Super Quatuor Libros Sententiarum* (Lyons: Jean Trechsel, 1495), II, 5 H.
 40. *Sent.* II, 19 O.
 41. *Sent.* II, 19 P.
 42. *Sent.* I, dist. xli, qu. 1 K.
 43. *Opus Nonaginta Dierum* (Lyons: Jean Trechsel, 1495), ch. 95 (no foliation); see esp. § *Nota de duplici potentia dei*. Cf. *Quodlibeta Septem una cum tractatu de sacramento altaris* (Strasbourg, 1491), Quodl. VI, qu. 6; English translation of this question in Richard McKeon, *Selections from Medieval Philosophers*, II (New York, 1930), pp. 372-375.
 44. *Sent.* I, dist. xli, qu. I K. For a more complete analysis of Ockham's position see Oakley, "Medieval Theories of Natural Law," pp. 68-72.
 45. For d'Ailly's views see, e.g., *Quaestiones super libros Sententiarum* (Lyons, 1500), I, qu. 9, art. 2 S, fol. 122 r; and for Gerson, L. Vereeke, "Droit et morale chez Jean Gerson," *Revue historique de droit français et étranger*, XXXII (1954), pp. 413-427.
 46. See W. Kölmel, "Von Ockham zu Gabriel Biel: Zur Naturrechtslehre des 14 und 15 Jahrhunderts," *Franziskanische Studien*, 37 (1955), pp. 218-259.
 47. *De Legibus ac Deo Legislatore*, Bk. I, ch. 5, 8-9; *Selections from Three Works of Francisco Suarez S. J.*, I (Oxford, 1944), p. 26.

48. *D. Martin Luthers Werke*, 43 (Weimar, 1912), p. 71—"Vorlesungen über 1 Mose," ch. 19, 14; cf. also ch. 19, 17-20 and ch. 20, 2.
49. Georges de Lagarde, *Recherches sur l'esprit politique de la Reforme* (Douai, 1926), pp. 147-187.
50. John T. McNeill, "Natural Law in the Teaching of the Reformers," *The Journal of Religion*, XXVI (1946), pp. 177-178.
51. *Institutio Christianae Religionis*. Bk. IV, ch. 20, § 16; (Berlin, 1846), p. 486. Cf. the voluntarism of the Protestant scholastic Zacharius Ursinus (1534-84), *Opera Theologia*, I (Heidelberg, 1612), p. 483.
52. Bk. II, ch. 6, 20-23; pp. 126-128.
53. *Apologia pro Joanne Gersonio* (Lyons, 1676), pp. 4-7.
54. *De Jure Naturae et Gentium* (London, 1672), Bk. II, ch. 3, § XX.
55. *Leviathan*, Part II, chs. 30-31; ed. Michael Oakshott (Oxford, 1946), pp. 219-235.
56. *A Compleat Body of Divinity* (Boston, 1726), Qu. XIV, Sermon LIV, p. 188. It should be noted that Willard was less extreme on this matter than were many of his predecessors among the New England divines—cf. Qu. IV, Sermon XXIV, p. 76.
57. *Commentaries on the Law of England*, Sect. II, 40; (New York, 1830), p. 26.
58. Preston, *Life Eternall or A Treatise of the Knowledge of the Divine Essence and Attributes*, 2nd ed. (London, 1631), Part I, p. 143; Ames, *The Marrow of Sacred Divinity* (London, 1642), Bk. 2, ch. 3, § 14, p. 210; Bk. 1, ch. 5, pp. 44-45; Norton, *The Orthodox Evangelist* (London, 1654), ch. 4, pp. 91-95.
59. Sanderson, *De obligatione conscientiae Praelationes Decem* (London, 1710), Praelectio Quarta, pp. 97-101. This work was first published in 1660 at the request of Robert Boyle, to whom it is dedicated. Culverwell—*An Elegant and Learned Discourse of the Light of Nature* (London, 1652), chs. VI and IX, pp. 78, 98-99—professes a modified form of voluntarism.
60. *Essays on the Law of Nature*, ed. W. van Leyden (Oxford, 1954), Essays I and VI, pp. 110-113, 187-189; cf. the editor's introduction (pp. 37-43) where he points out the extent to which Locke was influenced by Culverwell and Sanderson. Grew, *Cosmologia Sacra* (London, 1701), Bk. 3, ch. 5, § 4, p. 121. Cf. also John Wilkins (1614-1672), also a Fellow of the Royal Society, who is, however, more ambiguous on this point—*Of the Principles and Duties of Natural Religion* (London, 1675), Bk. II, ch. 9, pp. 395-396.
61. *Treatise concerning immutable morality*, Bk. I, ch. 3, 1; New York, 1838), p. 18. It is worth noting that Cudworth, along with other Cambridge Platonists who attacked ethical voluntarism, did so in terms of a theory of immanent or quasi-immanent natural law—see Cudworth, *Treatise*, Bk. I, ch. 2, § 2, p. 14; Bk. IV, ch. 6, § 3, p. 130. Cf. Edward Fowler (1632-1714), *The Principles and Practices of Certain Moderate Divines of the Church of England abusively called Latitudinarians* (London, 1671), pp. 12-13, and J. Tulloch, *Rational Theology and Christian Philosophy in the Seventeenth Century*, II (London, 1872), pp. 172-173, 435-436, where he discusses the views of George Rust (d. 1670) and John Smith (1618-1652).
62. *Treatise*, Bk. I, ch. 1, § 4, p. 9.
63. Cf. A. P. d'Entrèves, *Natural Law; An Introduction to Legal Philosophy* (London, 1951), p. 11.
64. *S.T.*, Ia 2ae, qu. 91, art. 2 *Resp.*
65. *History of Christian Philosophy*, pp. 410, 498. Cf. *Quodl.* VI, qu. 6; McKeon, II, p. 373; L. Baudry (ed.), *Le Tractatus de Principiis Theologiae attribué à G. d'Occam* (Paris, 1936), p. 45 and n. 1.
66. Thus God can produce in us intuitions of non-existent objects—*Quodl.* VI, qu. 6; McKeon, II, pp. 372-380.
67. Baudry, p. 23.
68. See e.g. Perry Miller, *The New England Mind* (New York, 1939), pp. 157-158, and H. A. Rommen, "The Natural Law of the Renaissance Period," *University of Notre Dame Natural Law Proceedings* (Notre Dame, 1949), pp. 94-95.
69. *Sent.* III, 12 CCC.
70. *Opus Nonaginta Dierum*, ch. 95, § *Hereticum est dicere omnia de necessitate evenire*.
71. See A. C. Crombie, *Medieval and Early Modern Science*, II (New York: Anchor Books, 1959), pp. 32-33.
72. *Ibid.*, p. 313.
73. *Sent.* Prol., qu. VII; *Sent.* II, qu. 19 O. Again, discussing the distinction between the absolute and ordained powers of God, Ockam can say: "... est sic intelligenda quod posse aliquid aliquando accipitur secundum leges ordinatas et institutas a Deo, et illa Deus dicitur posse facere de potentia ordinata; aliter..." etc. (*Italics mine*).—*Quodl.* VI, qu. 1.
74. *De libertate creaturae rationalis*, in J. Gerson, *Opera Omnia*, ed. Ellies du Pin, I (Antwerp, 1706), col. 632; *De Trinitate*, in Gers., I, col. 619;

- Quaestiones super I, III et IV Sententiarum* (Lyons, 1500), I, art. 2 JJ, fol. 96r. He also uses the expression *by the natural or naturally ordained power* in contrast with *supernaturally ... or by the absolute power*—Sent. IV, qu. 1, art. 2 J, fol. 188r.
75. Sent. IV, qu. 1, art. 2 N, fol. 188r; *Tractatus de Legibus et Sectis*, in Gers., I, col. 793.
 76. The *General Scholium* which Newton appended to the second edition of the *Principles* contains the clearest statement of his physico-theological principles. In it he was careful to affirm, not only that "this most beautiful system of the sun, planets and comets could only proceed from the counsel and dominion of an intelligent and powerful Being," but also that this Being is to be considered as an omnipotent cosmic sovereign who "governs all things, not as the soul of the world, but as Lord over all"—*Opera Omnia*, III, pp. 171-173.
 77. *The Darkness of Atheism dispelled by the Light of Nature: a physico-theological Treatise* (London, 1652), ch. 4; Sect. 5, pp. 125, 136; cf. Nehemiah Grew, *Cosmologia Sacra*, Bk. 4, ch. 5, pp. 194-195.
 78. *Darkness of Atheism*, ch. 10, Sect. 1, p. 329.
 79. *A Free Inquiry into the Vulgarly received notion of Nature*, Works, V, p. 197; *On the Excellency and Grounds of the corpuscular or mechanical philosophy*, Works, IV, p. 68.
 80. *The Christian Virtuoso*, Works, V, p. 521.
 81. *A Free Inquiry*, Works, V, p. 216.
 82. *Some considerations about the Reconcilableness of Reason and Religion*, Works, IV, p. 159.
 83. *Of the High Veneration Man's Intellect owes to God*, Works, V, p. 149.
 84. Ulrich Zwingli, *Ad illustrissimum Catorem Principem Philippum sermonis de providentia dei anamnema* (Zurich, 1530), fols. 20r, 63r; Philip Melancthon, *Initia doctrinae physicae, Opera Omnia*, ed. C. G. Bretschneider, XIII (Halis Saxonium, 1846), pp. 206-207. Cf. Ursinus, *Opera Theologica*, I, col. 573.
 85. *Sacra Theologia* (Geneva, 1589), Bk. 2, ch. 10, fol. 18r; cf. William Perkins (1558-1602), *An Exposition of the Symbole of the Creed of the Apostles*, Works, I (Cambridge, 1612), p. 160.
 86. Ames, *Marrow*, Bk. 1, ch. 9, p. 40; cf. Increase Mather, *The Doctrine of Divine Providence Opened and Applied* (Boston, 1684), Sermon 2, p. 45; Samuel Willard, *Compleat Body*, Qu. XI, Sermon XLVII, p. 146.
 87. Willard, *Compleat Body*, Qu. IV, Sermon XII, p. 38, Qu. XI, Sermon XLVII, p. 146; Increase Mather, *Doctrine of Divine Providence*, Sermon 2, p. 47; cf. Norton, *Orthodox Evangelist*, ch. 5, pp. 103-104.
 88. *Metaphysicarum Disputationum*, I (Moguntiae, 1600), Disp. XXII, § 4, pp. 568, 569; II, Disp. XXX, § 17, p. 150; *De Legibus*, Bk. 2, ch. 2; *Selections*, I, p. 104.
 89. *De Legibus*, Bk. 1, ch. 1, Bk. 2, ch. 2; *Selections*, I, pp. 8 and 104; *Met. Disp.*, II, Disp. XXX, § 17, p. 150. Robert Boyle himself came very close to the same position—see *The Christian Virtuoso*, Works, V, p. 521.
 90. *Essays on the Law of Nature*, Essay I, pp. 108-110; Sanderson, *De oblig. consc.*, Prael. Quarta, p. 101. Locke's editor suggests that the position of Locke as well as that of Culverwell was influenced by that of Suarez (pp. 36-37).
 91. "The significance of Medieval Discussions of Scientific Method for the Scientific Revolution," in *Critical Problems in the History of Science*, ed. Marshall Claggett (Madison, 1959), p. 80.
 92. Charleton, *Darkness of Atheism*, fols. a2v, b4v. Scrutiny of the catalogue of Ames's library reveals that he possessed a rich collection of scholastic material ranging from Aquinas to the Spanish scholastics of the sixteenth century, and including among others works of Scotus, Buridan and Gabriel Biel—see *Catalogus variorum et insignium librorum clariss. et celeberrimi viri D. Guilielmi Amesii* (Amsterdam, 1634).
 93. *Orthodox Evangelist*, fols. 1v-2r.
 94. *Immutable Morality*, Bk. 1, ch. 1, § 5, p. 11.
 95. Although it is unimportant in the present context, it should perhaps be noted that this distinction underwent slight fluctuations in meaning in the course of the three centuries during which it was current.
 96. D'Ailly, *Sent.* I, qu. 13, art. 1 D, fol. 159r; Major, *In primum Sent.*, dist. 44, qu. 3.
 97. See Gordon Leff, *Bradwardine and the Pelagians* (Cambridge, 1957), pp. 165-254.
 98. It is cited explicitly, to my knowledge, by Luther, *Vorlesungen über I Mose*, ch. 19, 14-20, ch. 20, 2; *Werke*, 43, pp. 71-72, 82; the Anabaptist Balthasar Hubmaier, *Das ander Biechlen von der Freywilligkeit der menscheng*

- ... (Nicolsburg, 1527)—English translation in G. H. Williams (ed.), *Spiritual and Anabaptist Writers* (Philadelphia, 1957), pp. 132-133; William Perkins, *A Godly and learned Exposition, Works*, III, pp. 233-234; Suarez, *Met. Disp.*, II, Disp. XXX, Sectio 17, p. 150; Ames, *Marrow*, Bk. 1, ch. 6, §§ 16-20, p. 21; Norton, *Orthodox Evangelist*, ch. 1, p. 19, and Willard, *Compleat Body*, Q. 4, Sermon 22, p. 70. And it is at least implied in some of the arguments of Melancthon, *Initia Doctrinae Physicae, Opera Omnia*, XIII, p. 207, and Robert Boyle himself—*Some Considerations about the Reconcilableness of Reason and Religion, Works*, IV, pp. 161-163. Cf. Malebranche's distinction between the 'general' and 'particular' will of God which is very similar in its import—see Ginette Dreyfus, *La Volonté selon Malebranche* (Paris, 1958), pp. 101-109.
99. *The New England Mind*, pp. 33-34.
100. Ames, *Marrow*, Bk. 1, ch. 9, p. 41; Shepard, *The First Principle of the Oracles of God, in Three Valuable Pieces* (Boston, 1747), pp. 9-10; Norton, *Orthodox Evangelist*, ch. 5, pp. 103-104; Mather, *Doctrine of Divine Providence*, Sermon 2, qu. 2, pp. 45-47.
101. Wilkins, *Principles and Duties of Natural Religion*, Bk. 1, ch. 7, pp. 85-87; Charleton, *Darkness of Atheism*, ch. 4, Sect. 5, pp. 136-137; Boyle, *A Free Inquiry into the Vulgarly received notion of Nature, Works*, V, pp. 197-198, 211, 216.
102. *A Free Inquiry, Works*, V, pp. 163-164.
103. *Some Considerations, Works*, IV, pp. 161-162 (italics mine).
104. Boyle, *Some physico-theological considerations about the possibility of the Resurrection, Works*, IV, pp. 201-202; *A Disquisition about Final Causes, Works*, V, pp. 412-414; Luther, *Werke*, 43, p. 71; Melancthon, *Opera Omnia*, XIII, p. 207; Suarez, *Met. Disp.*, I, Disp. XXII, p. 552; Perkins, *An exposition of the Symbole, Works*, I, p. 159, *A Resolution to the Countreyman, Workes*, III, p. 657, *A Discourse of the Damned Art of Witchcraft, Workes*, III, p. 609; Preston, *Life Eternall*, Part I, p. 32, Part II, p. 200; Ames, *Marrow*, Bk. 1, ch. 9, p. 40; Shepard, *Three Valuable Pieces*, pp. 9-10; Norton, *Orthodox Evangelist*, ch. 5, p. 124; Increase Mather, *Doctrine of Divine Providence*, Sermon I, pp. 23-24, Sermon II, pp. 53-54; Willard, *Compleat Body*, Qu. XI, Sermon XLVI, p. 144.
105. It is perhaps worthy of note that many of these authors also make use of another distinction related to that which they drew between the absolute and ordained powers of God. This distinction concerned the order of salvation and was drawn between what Calvinist theologians usually referred to as the *secret* will and the *revealed* will of God, but which the Scholastics called *voluntas beneplaciti* and *voluntas signi*. Its history can be traced back as far as the *De Sacramentis Christianae Fidei* of Hugh of St. Victor (1096-1141)—Bk. I, Part 4, ch. 8 (*Patrologia latina*, ed. J.-P. Migne, 176 [Paris, 1854], col. 237), but it consorted very profoundly with the voluntarism of the Ockhamists and became a commonplace of Protestant thought. It was cited, for example, by Hubmaier — *Spiritual and Anabaptist Writers*, pp. 132-133; William Perkins, *A Treatise of God's free grace, Workes*, I, pp. 704-705; Ames, *Marrow*, Bk. 1, ch. 7, §§ 52-54, pp. 30-31; John Norton, *Orthodox Evangelist*, ch. 4, p. 92; Hobbes, *The Questions concerning liberty, necessity and chance clearly stated and debated between Dr. Bramhall Bishop of Derry, and Thomas Hobbes of Malmesbury* (London, 1656), pp. 10 and 78. It was used, among the members of the Royal Society, not only by the staunchly Calvinist John Wallis—*A brief and easie explanation of the Shorter Catechism* (London, 1662), E 4 — but also by Charleton, *Darkness of Atheism*, ch. 10, 4, p. 354. Cf. also Sanderson, *De oblig. consc.*, Prael. quarta, p. 97.
106. Hardly surprising for, according to d'Ailly, "just as the divine will is the first efficient cause in the genus of efficient causality, so also is it the first obligating rule or law in the genus of obligating law"—*Sent.* I, qu. 14, art. 3 Q, fol. 173r.
107. *Metaphysical Foundations of Modern Physical Science*, p. 294.
108. Needham, *Science and Civilization*, II, p. 582.
109. *Science of Mechanics*, trans. T. J. McCormack (London, 1942), pp. 542, 551-552; cf. Mortimer Taube, *Causation, Freedom and Determinism* (London, 1936), pp. 108-109.
110. A. N. Whitehead, *Science and the Modern World* (New York, 1958), p. 14; R. G. Collingwood, *Idea of Nature*, pp. 3-9; Foster, "The Christian doctrine of Creation and the rise of Modern Natural Science," *Mind*, XLIII (1934), pp. 446-468, "Christian Theology and Modern Science

- of Nature," *Mind*, XLV (1936), pp. 1-28. Cf. e.g. E. L. Mascall, *Christian Theology and Natural Science* (London, 1956), pp. 93-100.
111. *Mind*, XLIII (1934), p. 465.
112. *Science and Civilization*, II, pp. 578-583.
113. *Ibid.*, p. 543.
114. *Ibid.*, p. 582—Needham adds that "Modern Science and the philosophy of organism, with its integrative levels, have come back to his wisdom, fortified by a new understanding of cosmic, biological and social evolution. Yet who shall say that the Newtonian phase was not an essential one."
115. As long ago as 1909 Pierre Duhem drew attention to the importance of

these condemnations for the history of science — *Etudes sur Léonard de Vinci*, II (Paris, 1909), pp. 411 ff. He did so, however, because he believed that the utterances of the Bishop of Paris on specific points such as the possibility of the existence of a plurality of worlds marked the starting point of the development of modern science, and Alexandre Koyré has convincingly exposed the lack of evidence to support such a belief—"Le vide et l'espace infini au XIV^e siècle," *Archives d'hist. doct. et litt. du Moyen Age*, 24 (1949), pp. 45-91. But if the condemnations and the theological reaction to which they witnessed were unimportant in the realm of specific scientific discoveries, this was far from being the case in the realm of philosophical assumptions about nature—a point which Koyré apparently failed to perceive.



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