Ch I: Scholastic Philosophy and Thomism

It has been emphasized by many authors that modern science is much less “rational” than ancient and mediaeval science. Whitehead states flatly in his book Science in [and?] the Modern World that modern science is based on faith while mediaeval science was based on reason. [note 1] This means, obviously, that modern science takes the laws of nature (e.g., Newton’s laws of motion) as “hard facts” which have to be taken for granted and cannot be “proved,” while mediaeval Thomistic writings attempted to derive physical laws from “intelligible” facts. The prominent American historian Carl Becker [note 2] tried to show that modern science has become less and less rational, that twentieth century science should be bluntly called “irrational.” As a matter of fact, Becker himself uses, as many “humanists” do, the words “logical” and “illogical,” which is a way of speaking which is not in agreement with the way in which these words are used in science. A system of statements would be called “illogical” in science if, and only if, it contained a logical contradiction. This is certainly not the case in modern science any more than in mediaeval science.

What Becker calls “logical” is what Aristotle called “intrinsically intelligible” or what is often called simply “understandable.” A statement or system is “intelligible” if it can be derived logically from principles that are self-evident. In this sense every “stubborn fact” that we have to take just as it comes is “illogical.” In modern writing, the word “rational” is usually substituted for Aristotle’s “intelligible” or “understandable.” In order to understand clearly Becker’s statement, one should replace “logical” by “rational” in the scientific statements encountered. In The Heavenly City, Becker characterizes the spirit of modern science as follows:

Facts are primary and what chiefly concerns us: they are stubborn and irreducible and we cannot get around them. They may be in accord with reason, let us hope they are, but whether they are so or not is only a question of fact to be determined like any other.

To say that “a series of facts is in accord with reason” means only that they can be logically derived from intelligible principles; it has nothing to do with the logical consistency of these facts. “This subtle shift in the point of view,” Becker continues, “was perhaps the most important event in the intellectual history of modern times, but its implications were not at once understood.”

The “subtle shift” was, of course, the decline of belief in the possibility of deriving all observable facts from intelligible principles or, in other words, the decline of belief in a rational world picture. Becker writes:

In the course of the nineteenth century this optimistic outlook became overcast. The marriage of fact and reason, of science and the universal laws of nature, proved to be somewhat irksome, and in the twentieth century it was, not without distress, altogether dissolved.... If logic presumes to protest in the name of law, they (the scientists) know now how to square it, so that it complaisantly looks to the other way while they go on with illicit enterprises—with the business, e.g., of teaching the wave theory of light on Monday, Wednesday, and Friday, and the quantum theory on Tuesday, Thursday, and
Saturday. This is certainly an incorrect presentation of the twentieth-century theory of light, and it would be interesting what light happens to be on Sunday. The historian Becker presents the history of science as if omissions in logic would increase more and more in modern science and while the scientist works "logic has to look the other way."

What has actually happened in the history of science is the phenomenon that science becomes less and less rational, and this means again that the departures of twentieth-century theories from common-sense experience become greater and greater. In twentieth-century theory of light there is certainly no departure from logic, but conspicuous departures from the laws by which the experience of our daily life has been properly described. We have learned previously that the increasing departure from "logical," or rather "rational" theories in the physical sciences means actually a departure of physical theories from formulations that can be expressed in common-sense language. However, the human mind is not satisfied with this trend, and wants, as we discussed previously (in Chapter I), a return to a rational picture of the physical world. To these "rational pictures" belongs, in particular, the picture given by traditional Christian and Jewish religion and all kinds of teleological philosophies which explain physical phenomena in nature by their analogies with the events that happen in an artisan's shop as the result of the artisan's purpose and blueprint.

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The urge of the human mind towards rational pictures has resulted in "philosophical systems;" they are, practically, rational pictures of the universe which have been worked out systematically and elaborately. According to what we have learned previously, we know that people who use the same rational picture of the physical universe will also have many moral and political ideas in common. Hence, a certain comradeship or friendship develops and a "school," in the philosophical sense, emerges. These schools have had a great cultural and social influence; knowing and analyzing the main philosophical schools adds much to our understanding of a period in history, particularly our own period. In order to understand contemporary philosophy of science, it would certainly be helpful to know the philosophical schools of our period which devote much attention to philosophy of science. In order not to diverge from our main topic, we shall discuss only those contemporary "schools" in which, on the one hand, philosophy of science has been believed to be pertinent, for good or evil, by political, social, and religious organizations.

According to these criteria, we are restricting ourselves to three schools or systems: the Thomistic philosophy which is the main philosophy of the Roman Catholic Church; Dialectical Materialism which is the official philosophy of the Communist Party and of the Soviet State; and[,] third, positivism or pragmatism which has been the main stream in twentieth-century science, and has had a decisive influence upon the lines of thought in the Western democracies, particularly in the Anglo-Saxon and Scandinavian countries. A fourth school of philosophy that fulfills our requirements would be "Idealism" of the Kantian or Hegelian variety. This line of thought has played a tremendous role in the understanding of the intellectual and social life in Germany and the countries which have been under German influence. We shall, however, restrict ourselves to the doctrines that have shaped the international interpretation of contemporary science. Occasionally, however, we shall discuss some effects of
idealism upon the interpretation of science.

If it is generally true that the philosophical interpretations of science have their origin in a longing for a rational understanding, it is particularly true of the approach of the Thomistic School to science. We can obtain a lively understanding of this attitude by reading some passages from Recollections of Seventy Years, published by William Cardinal O’Connell (Boston, 1933). The late Cardinal had a strong interest in the philosophical interpretations of twentieth-century science and was gravely concerned about the materialistic implications which could be derived, according to his opinion, from the theory of relativity, if it were presented without a proper philosophical interpretation—an interpretation which he believed could only be provided by Thomistic philosophy. Speaking about Pope Leo XIII, who was responsible for a mighty revival of Thomistic philosophy in the period (after 1800) that preceded the rise of twentieth-century physics, the Cardinal writes (p. 23):

He saw very clearly that while great discoveries had been made in the world of physical laws and material science, the conclusions drawn from the premises, though superficially attractive, were logically false and destructive of genuine Catholic philosophy.

It is particularly instructive to read how Leo XIII, in his seminary in Perugia, characterized Thomistic philosophy in contrast to the way of thinking that was customary among physicists. He led the students, as Cardinal O’Connell expresses it, to the teaching of the great master of thought (Thomas Aquinas) of which the church had such reason to be proud, but which the world of physical science was striving to bury beneath the disorderly mass of mere speculation—the vogue at the universities of that time.

This refers to the time after 1880, and if Pope Leo were alive today he would scarcely believe that the vogue at the universities is less inclined to mere speculation in physics. The Cardinal writes that “the somewhat flamboyant mentality of the scientists of that day had little reverence for the exact intellectual processes of the Thomistic system.” Although Thomistic philosophy has had a conspicuous revival, one would hardly say that the mentality of the average scientist today is “less flamboyant” or has “more reverence” for the syllogistic system of St. Thomas. What the Thomistic interpretation has pledged to offer the scientist is, as we have learned, “less speculation and more exact syllogistic processes.” A prominent Thomistic philosopher, J. A. MacWilliams, writes [note 3]: “Perhaps the greatest mission of our metaphysics today is to justify itself in the eyes of the scientists and to show them that it is what they need in order to rationalize their various scientific disciplines.”

The main feature in the Thomistic interpretation of physical phenomena is the elaboration of analogies with the phenomena observed in living organisms, particularly in human beings. E. F. Caldin writes:
Thomistic philosophy pays greatest attention to intellectual beings.... [N]on-rational living organisms occupy a subordinate position and dead matter is considered as interesting largely because it is capable of being actualized by some higher form. More specifically: Thomas’ philosophy places God at its apex (summit).... [I]t treats man as an intellectual being...developing towards God; its treatment of other living organisms is analogous to man in respect to live, but distinct in respect to intellect....

The Thomistic philosophy believes that “physics,” in the modern sense, a theory of the motion of “dead matter” without considering [it?] living and intelligent, is impossible. Caldin continues:

Because of this attention to living and intelligent beings Thomistic philosophy perceives the scale of perfection among essences, the analogy of being in its “vertical” dimension, which is overlooked by those who restrict the object of their philosophies to the dead world.

The attitude of contemporary Thomism to physical science is lucidly described by the Reverend Joseph T. Clarke, S.J. [note 5] who is thoroughly familiar with contemporary scientific methods. He wrote

The same physical reality of a common shared experience forms the material object or subject matter of both science and philosophy. But their respective formal objects, or the precise points of view under which each study examines an identical subject matter, are distinctly different.

We may consider as an example the motion of a falling stone. The scientist asks, according to Father Clarke, what is the motion of the stone? The answer is the description of the stone’s position as a function of time and the derivation of this motion from simple laws, like Newton’s laws of motion. If we know all this, we know what the motion is. The answer is given in terms of centimeters, grams, seconds, etc. After the scientist has answered his question, the philosopher asks a further question: what is motion? This means: How can I describe motion if I do not use measurable properties but intelligible properties? By this he means expressions that occur in our formulations of intelligible, self-evident propositions about the objective reality.

There are, according to J.T. Clarke, “alternative vocabularies, each of which is irrefutably valid, irreducibly different, but not irreconcilably opposed, rather mutually complementary.” This sentence accentuates the point that the relation of the scientific description to the philosophical description of the same condition may be analogous to the relation between two complementary descriptions of an atomic object, according to Bohr’s principle of complementarity. In order to understand the relation of these two complementary descriptions, we must, above all, know what properties constitute a philosophical description of a situation. Clarke gives the following example of his “alternative vocabularies.” From the scientific point of view, we may “describe an atom or an organization as a configuration of electrons or as a colony of cells in thermodynamic equilibrium,” but from the philosophical point of view one may describe the same atom or the same organization “as a substance, composed of two substantial
coprinciples, known as prime matter and substantial form in the technical jargon of philosophy.” Both descriptions are equally true. Clarke says that they are equally true in the sense in which it is equally true that a Mr. Smith is a Democrat, a wheat farmer and a Baptist, all at once. As physical science has a theory of matter, according to which an atom consists of nucleons and electrons, so Thomistic philosophy has a theory of matter, according to which the same atom consists of prime matter and substantial form.

The assertion that every atom and every organization consists of prime matter and substantial form has its origin in an application of common-sense experience to fields of physical and biological science. Greek philosophers, like Plato and Aristotle, compared objects that we find in nature, such as stones, plants, and animals, with objects that are made by human artisans. If a sculptor produces a cube in marble, we can easily distinguish between the material that he uses, marble, and the form which he gives to it, a cube. The marble is passive, it serves the sculptor only as the material on which he works; but the cubic form is active, since it presents a goal which the sculptor attempts to achieve. If we apply to the conception of “marble” as passive material a more subtle analysis, we shall easily find that it is not completely passive. Its parts are held together by forces of cohesion which act upon them. Hence Aristotle described a piece of marble as consisting of “prime matter” or “primary matter,” which is completely “passive” and “inert,” and a “substantial form” to which not only the form or shape in the geometrical sense belongs but also all “forces” that act upon the marble, not only cohesion but also repulsion (impenetrability), gravity, electromagnetic field, etc.

In his book on Modern Thomistic Philosophy, Philipps [note 6] presents the theory of matter by three propositions: 1. There is in bodies a substantial material principle and a substantial formal principle. 2. Both these principles are incomplete substances. 3. The material principle has the same relation to the formal principle as potentiality to actuality. The last two terms are explained by the author by the following example: when we say “John can read,” John has the “potentiality” of reading; when, however, we say “John is reading,” he has the actuality. For the terms “material and formal principle” the author gives an explanation by using a highly popularized example. “The flour, raisins, eggs, etc.” the author writes are the material principles of the plum pudding, but these have to be combined in the proper proportions, mixed and boiled in a certain way in order to obtain a plum pudding. The result of such combination, mixing, etc. is the formal principle of the plum pudding, making it different from other kinds of pudding.

Such popularizing examples are in some respects misleading. The “prime matter” of Thomistic philosophy is not the same concept as that of “matter” in everyday language and elementary science. The elements—earth, fire, water, etc.—are all the same prime matter in different forms. “Prime matter” means what is common to all kinds of matter in the ordinary sense of this term. If a change takes place in which one kind of matter is transformed into a different kind, we speak of “substantial change.” The existence of such changes was, for St. Thomas and his
school, a proof of the coexistence of matter and form in every material body, because in every substantial change the form changed while the matter remained the same. For mediaeval philosophy, the conversion of wood into ashes or into fire was an example of a substantial change. Every death was a conversion of living matter into inorganic matter. In every material body prime matter and substantial form are not only conceptually distinguishable, but, according to a theorem of Thomistic philosophy, “even in inorganic bodies prime matter is physically distinct from substantial form.”[note 7] This was evident from the existence of substantial changes where actually the form changed while prime matter remained unchanged.

The rise of modern science brought about a new conception of the process of combustion. According to the new chemistry, there were the same types of matter in the ashes and the fire that there were in the fuel and the air. No substantial change took place and there was no reasons to assume that wood and ashes contained the same prime matter under different forms. Along with the advance of the physical and biological sciences it became obvious that it would be difficult to tell in each individual case whether what was taking place was a “substantial change” or just a change in the position of matter. If hydrogen and oxygen combine to form the compound water, the Thomistic philosophers have not all agreed as to whether this is a “substantial change” or the forms of the constituents continue to exist in the compound. Colligan, in his book on Cosmology, [note 8] writes that the transmutation of chemical elements and the formation of organic compounds from their constituents are certainly substantial changes, but that the formation of an inorganic (non-living) compound, like water, form its components is “probably” only a substantial change. As a matter of fact, to speak in the language of science, the concept of “substantial change” has no operational meaning,..[??] The situation became still more complicated when isotopes and nuclear reactions in general were discovered. There has been much discussion among Thomists as to whether these transmutations are substantial changes or not. Fortunately, it is, for the social significance of Thomistic philosophy, irrelevant whether or not “substantial changes” really exist. What matters is only whether one can prove that “prime matter” and “form” are physically distinct from one another in every material body.

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If Mr. Smith is a Democrat, a wheat farmer, and a Baptist all at once, it depends upon the circumstances whether we prefer to describe him by one or another of those words. When we are canvassing votes, it is important to us to know whether or not he is a Democrat, but if we intend to provide food for India, it is important to know whether or not he is a wheat farmer. Each of the descriptions is equally true. As we learned from J.T. Clarke, it is equally true that our material world consists of atoms and organizations as that it consists of prime matter and substantial form. If we are interested in making an atomic bomb, it is practical to describe matter by atoms and their nuclear structure, and this description is certainly of high social significance. J.T. Clarke writes, however,

But to know the essential structure of an atomic substance (i.e. the description of matter and form) is to know the basic formula of the irresistible evidence for the existence of God. And that knowledge is, I submit, also of colossal social significance.
The author compares the technological usefulness of the conceptual structure that is used in nuclear physics with the moral usefulness of the conceptual structure of Thomistic philosophy. Each case is an example of social usefulness or significance.

In some respects this Thomistic view of the relation between science and philosophy is no different from the pragmatic view that we presented in the chapter on the sociology of philosophical interpretations of science [note 9]. According to this pragmatic view of science, one distinguishes between the technological and the moral purposes of a theory. The difference between the two views consists mainly in the way in which the moral “truth” is used. In order to understand this point precisely, it is necessary to understand how the Thomistic description of nature is used to derive statements about God, the angels, and other concepts that have been of high value for supporting rules of desirable human conduct. Perhaps the most important argument in this line is the Thomistic proof for the existence of God, based upon the Thomistic theory of motion. “Motion” in the Aristotelian and Thomistic terminology means every type of change, from hot to cold, from red to green, from life to death; it includes as a special case “local motion,” which coincides with our common concept of motion. The characteristic definition of motion in this philosophy is “the passage from the potential to the actual,” or “the actualization of the potential.” However, a body cannot perform this passage by itself, because this passage means the introduction of a form into prime matter that is apt to receive it. Since prime matter is completely passive and inert, it contains only the potentiality of change; the passage to the actual must occur, as E. Gilson writes [note 10]: “under the impulse of an act which is already realized” or, in other words, motion originates in “an imperfect act which completes itself.”

From this argument we can conclude that “whatever is in motion is moved by another.” This proposition, introduced by Aristotle, is the starting point in a Thomistic proof for the existence of God. We find it in St. Thomas Aquinas’ Summa Contra Gentiles, [note 11] and it also leans heavily in Aristotle. Aquinas writes:

Whatever is in motion is moved by another: and it is clear to the sense that something, the sun for instance, is in motion. Therefore, it is set in motion by something else moving it. Not that which moves it is itself either moved or not. If it be not moved, then the point is proved that we must postulate an immovable mover; this we call God. If, however, it be moved, it is moved by another mover. Either, therefore, we must proceed to infinity, or we must come to an immovable mover. But it is not possible to proceed to infinity. Therefore, it is necessary to postulate an immovable mover.

This mover cannot be a body, because an immovable body cannot produce motion in other bodies. The “prime mover” already introduced by Aristotle is identified by Thomas with the biblical God.

It is important to understand that this proof and similar proofs of Thomistic philosophy are not based upon the scientific analysis of our experience, but on the metaphysical analysis. Science eventually led to Galileo’s and Newton’s law of inertia, according to which a body which possesses a certain speed can move along without being moved by another body. This law would invalidate the Thomistic proof for the existence of the prime mover. However, we must keep firmly in mind that the
philosophical analysis of experience, in terms of matter and form, actuality and potentiality, is completely independent of the advances in science. Even if we accept, speaking in terms of physics, the law of inertia, it is possible that “metaphysical analysis” in the Thomistic sense would lead to the proposition that nothing can be moved unless it is moved by something else. Some Thomists interpreted the law of inertia by assuming that a moving body does not keep its speed without action from something else but would lose its speed unless God gave, at every instant, a push to the body. By this and similar interpretations, one cannot accept Newton’s laws and make mechanics technologically valuable, simultaneously sticking to the Aristotelian and Thomistic assumption that a body cannot be moved without getting movement from something else. Before we raise the question of how the Thomistic proof for the existence of a prime mover and similar proofs are different from proofs occurring in science, we shall present and discuss some other proofs that are given by Thomistic philosophy and are regarded as socially useful.

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In order to give to the structure of the universe a more balanced character, St. Thomas introduced between God and man the conception of “Angel.” In his Treatise on the Angels [note 13] he writes:

We consider the distinction of corporal and spiritual creatures, firstly, the purely spiritual creature which in Holy Scripture is called angel, secondly the creature wholly corporeal, and thirdly the composite creature, corporeal and spiritual, which is man...

Like everything in the world, angels consist of matter and form. For the understanding of these two fundamental concepts of Thomist philosophy, it is instructive to learn how St. Thomas applies them to the angels. The main problem is to find out whether spiritual substance consists of both prime matter and form. If this were so, corporeal and spiritual substance would contain the same prime matter. St. Thomas, however, argues:

But one glance is enough to show that there cannot be one matter of spiritual and corporeal things. For it is not possible that a spiritual and a corporal form should be received by the same part of matter; otherwise one and the same thing would be spiritual and corporeal. Since this is not possible, there would be one part of matter with a spiritual and one with a corporeal form. Since matter is quantity, the spiritual part must also be divisible, which is not possible.

Therefore, it is impossible that corporeal and spiritual things should have the same matter, and it is proved that an angel has only “form” and no “prime matter.”

We shall understand the Thomistic way of arguing better when we glance at the way in which St. Thomas derives the properties of angels.[note 14] Then he investigates the problem of “whether the motion of an angle be instantaneous.” According to the laws of Aristotelian mechanics, the speed of a body is proportional to the “power of the mover.” St. Thomas writes: “But the power of an angel moving himself exceeds beyond all proportions the power which moves a body.... If therefore a body is
moved in time, an angel is moved in an instant.” To this argument St. Thomas answers that

The speed of the angel’s motion is not proportional to the quantity of his motion, but to the determination of his will.... The time of the angel’s motion...will have no proportion to the time measured by the motion of corporeal things....

In other words, the meaning of the words “power,” “speed,” and “time” applied to an angel is not the same as when they are applied to material bodies. Therefore, the laws of motion that are valid for bodies like launched stones cannot be applied to an angel that is moving “under his own power.” The same thing[] holds also for the concept of “being in a place.” St. Thomas writes:

It is evident that “to be in a place” appertains quite differently to a body, to an angel, and to God. For a body is in a place in a circumscribing fashion, since it is measured by the place. An angel, however, is not there in a circumscribed fashion since he is not measured by the place, but definitely because he is in one place in such a manner that he is not in another. But God is neither circumscribing, nor definitely there, because he is everywhere.

It is interesting that St. Thomas mentions an objection which refers to the infinite speed of light, in order to make it plausible that an angel could also move with infinite speed. St. Thomas replies that “illumination is an alteration and not a local motion. But an angel’s motion is local and cannot be compared with the spread of illumination which is instantaneous.” We note again that words like “place,” “time,” “speed,” etc. have different meanings when they are applied to a moving angel than when they are applied to moving stones. Nevertheless, the word “place” in sentences referring to an angel and the word “place” in sentences referring to a material body are not homonyms or “equivocal” to each other. Two equivocal words like “rubber” as an elastic material and “rubber” as in a game of cards have meanings that are completely different from each other; the word “rubber” is equivocal. But the word “place” referring to an angel and referring to a moving stone has two meanings that have a certain range of meaning in common. The word “place” is not used equivocally as the word “rubber,” but is used, as scholastic philosophers express themselves, “analogically.” There are some sentences formed from such “analogical” words which make sense when they are spoken about an angel just as well as when they are spoken about a stone, e.g., “If an angel moves from one place to another, it has a speed and requires time.”

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We shall now give a second example in which analogical ways of speaking are used to prove important propositions of Thomistic philosophy. One of the most important points in a philosophical interpretation of science is the conception of what a “physical law” is. We have presented the three conceptions of physical law that were discussed by Whitehead. [note 15] One of these conceptions was the “imported law;” the law is an order imposed upon nature by a lawgiver. Thomistic philosophy has attempted to prove that the physical laws are actually imposed. It is very instructive to
study the nature of the proof. We shall follow the presentation of a textbook that has been introduced in colleges where Thomistic philosophy is a part of the prescribed curriculum.[note 16] The author starts from the definition that “Physical law is the fixed inclination with which irrational beings are endowed for the regulation of natural events.” This definition contains the analogical term “inclination,” which means verbally a state of mind and can, obviously, be attributed only to living beings. But our Thomistic definition speaks of the inclination of an “irrational being” which may even be a stone. The “inclination of a stone” makes sense only if we take the word inclination analogically or, as Charles Dickens said, in a “Pickwickian” sense. By observation and inductive inference, we find uniformities in nature, but no inclinations. This assertion was strongly emphasized by David Hume. Therefore, in the sense of our present definition, “uniformity of activity is not by itself a law, it is the effect of a law....” In the usual language of scientist, mention is often made of Newton’s laws, or Ohm’s law, etc., but actually these statements or formulae refer to uniformities and not to “laws” in the sense of our present definition.

In order to avoid using the term law in an equivocal sense, in Thomistic philosophy on speaks of “genuine laws” if one means laws in the sense of our definition. “Genuine Law,” our text states, “includes in its concept a superior and a subject; a genuine law is imposed. For that reason we say that natural objects are endowed with certain tendencies.” Then, Thomistic philosophy claims to prove the following proposition: “the activities of natural bodies are governed by Genuine Laws.” We shall attempt to present this proof in an abridged form. According to Thomistic philosophy, the study of the uniformities of nature belongs to the “special sciences” like physics, biology, etc. By means of the data of these sciences, the existence of genuine laws is not proved, but it is not excluded either. Our textbook states:

If we advance beyond the point at which science stops, that is only because philosophy should have no justification if it contributed to our knowledge nothing more than is contributed by the restricted natural sciences.

what philosophy in the Thomistic sense adds to the “restricted natural sciences” is the proof that the observed phenomena are regulated by laws that emanate from an intelligence and are imposed by a lawgiver. The proof starts with a generalization of our observation. We find the characteristic property that

The activities of our material world are highly rational. They fill the mind of man with wonder at the intelligence displayed.... Since material beings have no intelligence of their own, it follows that the intelligence they display is not their own. The case is parallel to that of a machine which displays the intelligence of the maker.

In this way it is proved that material bodies act according to a plan that is imposed by an intelligence from the outside. On the other hand, they act according to an internal necessity; therefore the plan is implanted in their very nature. “There it is imposed by the One Who has supreme charge of the material world,” in other words, by the Creator of the physical world, by God. According to Thomistic philosophy, this is the only way to understand the activities of matter. The theory of matter leads necessarily
to the result that matter is governed by genuine laws. If we add this argument to the proof for the existence of a prime mover, the belief in God is supported and along with it the moral rules that traditionally have been connected with this belief. There is no doubt that as a philosophical interpretation of the scientific theory of matter this argument is of high social significance. However it is also instructive to investigate the logical structure of this argument, if it is regarded as a proof of the regulation of physical uniformities by general laws. The argument starts from the remark that our empirical world displays a high degree of rationality. This means that, on the one hand, there are many uniformities that are governed by simple mathematical laws, like Newton’s law of gravitation, and, on the other hand, there are a great many phenomena that can be accounted for in a simple way, by ascribing to them a simple purpose—the physical phenomena in the human eye, e.g., serve the purpose of seeing. Both kinds of “rational behavior” have one thing in common: it is possible to see in the general physical behavior of bodies similarities with the behavior of bodies in our everyday experience. The law of gravitation can be interpreted as a combination of our daily experience of push and pull; the physical phenomena in the eye can be interpreted as being similar to the work of an artisan who manufactures a certain gadget. In other words, the physical universe looks similar to the product of an intelligent craftsman.

Now the terms “intelligence” and “craftsman” are used in an analogical way. We now introduce the expressions “intelligence” and “craftsman” which mean something different from but similar to these words as applied to human beings. As an intelligent craftsman produces a gadget, a superior intelligence and a superior craftsman produces the physical universe which is regarded as a machine or gadget in the analogical sense of the worlds. The argument of Thomistic philosophy is based essentially on the use of the analogical way of speaking and the analogical way of drawing conclusions. We take for granted that it is true for human intelligence and man-made gadgets is also true for craftsmen, intelligence, and gadgets on a higher level. The analogical character of the terms used is seen clearly from the fact that after it is shown that the world is made by its Creator, as a machine by its manufacturer, every effort is made to prove that the world isn’t really a machine in the scientific sense of this world. The world is a machine only in the analogical sense or, as we have called it before, in the Pickwickian sense.

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The prominent Thomistic philosopher G. B. Phelan [note 17] writes: “The importance of analogy in the philosophy of St. Thomas literally cannot be overestimated.” As we have learned from previous examples, the most important argument make use of analogical thinking. We may start again from the example discussed in the previous section. From the fact of our experience that a machine is always made by an engineer, and the fact that our universe is in some respects similar to a machine, we conclude that there is a Creator who is in some respects similar to an engineer who “made” the universe where the word “made” is analogical to the identically sounding word in the sentence: an engineer made a machine. While “machine,” “engineer,” and “universe” are terms that we are accustomed to use in describing our daily-life experiences, the concept of the “Creator of the universe” is produced by our analogical argument. Because of its great importance, we shall spend a little time this concept, although we can do it only in an abridge and perfunctory way, whereas actually a great deal has
been written about it by philosophers. According to a frequently used definition, analogy is the mean between univocity and equivocacy. In the two statements “an oak is a tree” and “an elm is a tree,” the word “tree” designates one and the same thing; it is used in an “univocal” way. But in the sentences “I climb a tree” and “A night I put my shoes on a tree,” the term “tree” has different meanings; it is used in an “equivocal” way, since “tree” means in the second sentence a “shoe tree.” But if we compare the sentences “the oak is a tree” and “Eve ate from the tree of knowledge,” the term “tree” is used in an analogical way because a tree in the ordinary sense of the word could give no knowledge to Eve.

The Catholic Encyclopedia (New York, 1907) attempts to familiarize the reader with the concept of “analogy” by relating it to concepts taken from daily life. [note 18] The author discusses as a simple example the “analogy of proportionality.”

Two objects may be related to each other not by a direct proportion but by my beans of another intermediary relation. For instance, the numbers 6 and 4 are analogous in the sense that 6:3 = 4:2; six is the double of three and four is the double of two.

Six and four are obviously different, but analogous because the play the same role in the proportion 6:3 = 4:2. This simple example shows, of course, that by the numbers 2, 3, 4, and the “proportion of analogy” the number six can be defined. But this number, like the numbers 2, 3, and 4, can be understood in terms of everyday-life concepts, while in metaphysics in the Thomistic sense concepts like “Creator of the Universe” are products of analogical thinking, are entirely new concepts, and cannot be explained on the basis of everyday-life language.

Phelan pointed out correctly that the method of analogy cannot be expressed by using only concepts that can be made clear by relating them to daily life experiences. He wrote: “Those who have attempted to express it in clear and distinct ideas have sinned against intelligence; for clear and distinct ideas banish mystery and bring death to metaphysics.” We can easily understand how analogical thinking brings mystery into metaphysics. To say that every material thing consists of prime matter and form is analogous to saying that the product of a sculptor consists of the material, e.g., marble, and the shape which his skill gives to it. The latter statement describes events of our daily life experience in common-sense language, in “clear and distinct ideas,” to use the famous words of Descartes. [note 19] But the concepts of “prime matter” and “substantial form” in general are introduced by analogy with those common-sense concepts. Because they are not directly reducible to common-sense experience, we say that they contain a “mystery.” In a similar way, we have the common-sense statement that the universe has a Creator.

In order to understand the relation of Thomistic philosophy to science, it is instructive to consider the similarity and the difference between analogical and scientific thinking. It is certainly true that the search for analogies has played an important role in the evolution of physical science. An example on a large scale and of great importance is “mechanistic” philosophy. The motions of medium-sized bodies, launched stones, cannon balls, etc., and even the motions of the planets around the sun can nowadays be described by rules that contain only terms of the common-sense language, if we extend the concept of daily life experience so far as to contain the phenomena
governed by simple applications of Newton’s laws. Mechanistic philosophy maintains that the optical, electromagnetic, and chemical phenomena, as a matter of fact, are governed by laws that are analogous to the mechanical phenomena in the narrower sense of this word. Then we would obtain statements in which terms like “intensity of light” or “density of electromagnetic energy” occur. If we applied only analogical thinking, these concepts would be defined only by the analogical argument; “electric energy” would be a concept not clearly reducible to concepts that can be communicated in common-sense language. There would be a “mystery” in “electricity,” as there is in “substantial form” and “Creator of the universe.” But the scientist introduces “operational definitions” or “semantical rules” by which he defines the new terms like “light intensity” or “electric energy” by describing the physical operations by which these quantities can be measured. The result of every measurement is the reading on a scale and can always be described in daily life language. “Intensity of light” can, e.g., be measure by reading a photometer, and “electric energy” by reading a voltmeter. Therefore, the concepts that are introduced by analogies are all connected with statements about daily life experience and defined by expressions in the common-sense language. Then all the statements in which these expressions occur can be checked by experiments that can be described in common-sense language. All experiments about electricity, e.g., can be described in the language of elementary mechanics.

The situation is quite different in metaphysics. It starts at the common-sense level, like science, but if by analogical thinking metaphysical concepts are reached, those concepts are ot “connectable” with common-sense statements; there are no operational definitions of metaphysical concepts and you cannot return actually to the common-sense level. There is no operational definition of “prime matter” or of “the Creator of the universe.” Jacques Maritain, one of the most prominent advocates of Thomistic philosophy, told a symposium in which the relation between science and metaphysics was under discussion that the main difference between science and metaphysics consists in the fact that science uses only univocal predicates, while metaphysics uses words in an analogical sense. What he meant is that many propositions that have a clear meaning on the “lower level” of daily life experience are used to designate analogous propositions on a “higher level” where they can no longer be checked by observations that can be formulated in common-sense language. The difference between the use of analogy in science and metaphysics was well formulated by Ernst Mach in his paper “On the Principles of Comparison in Physics.” [note 20?] He points out that a great many discoveries in science have been made by comparisons or analogies. Propagation of heat and light was treated as analogy to the motion of a fluid. Even today the nucleus of an atom is treated as analogous to a drop of fluid. However, these more or less vague ideas are not science until they are formulated in such a way that by means of operational definitions conclusions can be drawn about possible observations that can be described in common-sense language. Mach writes: “Not the dim, half-conscious surmises of the acute observer of nature belong to science, but only that which they possess clearly enough to communicate to others.” But whatever the role of analogical thinking may have been in advancing science, there is no doubt that this way of thought has produced a picture of the physical world that has had for centuries a great impact on the conduct of men.