ARTICLES

Metaphysics, the Old and the New Physics and the Emergence of Modern Philosophy

I

Perhaps the best manner of approaching the problematic of the emergence and of the distinctive characteristics of *modern philosophy* - that phase in the history of Western philosophy which is conventionally taken to commence with the work of Rene Descartes (1596-1650) - is by means of an initial attempt at a general characterization of the contrast which may be drawn between modern philosophy and the preceding phase of medieval philosophy. To do so it will be best to focus upon one fundamental theme: the manner how medieval philosophy and modern philosophy, respectively, conceived the discipline of metaphysics to be related to the discipline of the *theory of knowledge* or *epistemology.*

To be able to draw this contrast it will be useful to present, first of all, some general remarks about the history of the conception of metaphysics.[1]

Possibly the most widely known *historical fact* concerning the discipline of metaphysics is that it experienced a radical crisis during the eighteenth century. Indeed for the greater part, and certainly for most of the more significant representatives, of the Western philosophi-

[1]See: LOHR, Charles H., "Metaphysics" in *Cambridge History of Renaissance Philosophy,* Ed. SCHMITT, C., Cambridge: Cambridge University Press, 1988, pp. 537-638.

cal tradition since that time metaphysics, as a serious and respectable philosophical discipline, supposedly simply failed to survive that radical crisis. Metaphysics has, since the eighteenth century, generally been considered to be no more than illusory, and even out-right nonsense, and this both with respect to its much vaunted aspirations and its pretended conclusions.

The crisis which affected metaphysics during the eighteenth century was considered to be a *radical crisis* because it concerned the fundamental issue of the very possibility or viability of the discipline. This radical crisis resulted especially from the thorough critiques of the metaphysics *of the time* operated particularly by two great modern philosophers, David Hume (1711-1776) and Immanuel Kant (1724-1804). I have just stressed that the critiques of metaphysics carried out during the eighteenth century were attacks upon the metaphysics of the time. By this I intend to indicate that the metaphysics criticized by Hume and Kant was that kind of metaphysics with which they were acquainted.

The kind of metaphysics which was familiar to Hume and Kant, and which accordingly constituted the object of their critiques, was the kind of metaphysics which had been elaborated during the course of the seventeenth century. It was the kind of metaphysics which would be characterized by Kant himself as *dogmatic metaphysics* and which contemporary historians of philosophy usually refer to as *rationalist metaphysics.* It was the kind of metaphysics which had been gradually elaborated during the course of the seventeenth century and the first half of the eighteenth century by that group of continental European philosophers commonly designated by contemporary philosophical historiography as the *rationalists* and who are particularly represented by such first-rank philosophers as Rene Descartes (1596-1650), Baruch Spinoza (1632-1674), Nicolas Malebranche (1638-1715), Gottfried Wilhelm Leibniz (1646-1716) and Christian Wolff (1679-1754).

What were the essential characteristics of the *conception of metaphysics* presupposed by this rationalist metaphysics which, supposedly at least and certainly in the opinion of the greater part of Western philosophers since the eighteenth century, was thoroughly refuted by the attacks upon it mounted by Hume and Kant?

The rationalist conception of metaphysics envisaged metaphysics as being a two-fold discipline. It was supposed to consist of two distinct branches which eventually would come to be known as (1) *general metaphysics* and (2) *special metaphysics.* This two-fold manner of

conceiving the discipline of metaphysics was not invented by the great rationalist philosophers of the seventeenth century. Rather, they simply inherited, in its essentials if not necessarily in its nomenclature, this conception of metaphysics from the manualistic tradition of late scholasticism which had gradually, and especially during the final decades of the sixteenth century, elaborated this conception of metaphysics as its peculiar interpretation (one could well argue, mis-interpretation) of the nature and structure of properly Aristotelian metaphysics.

In other words, the philosophers of the seventeenth century - and here one ought to include not only the rationalist metaphysicians but also those empiricist philosophers, such as Pierre Gassendi (1592-1655), who would reject the very possibility of metaphysics as advocated by the rationalists - simply received this conception of metaphysics from the closing phases of medieval philosophy.

Let us now turn to a brief consideration of each of these two branches of late scholastic and, subsequently, of rationalist metaphysics.

(1) *General Metaphysics* - also variously referred to as *ontology* and as *first philosophy*. This is conceived as a discipline which is not considered to have as its proper object, or direct subject-matter, a materially distinct kind of object. Its subject-matter is not at all deemed to be materially distinct from the subject-matter treated by other parts of philosophy - or, indeed by any other science whatsoever. All objects, all entities, no matter how they might differ materially, enter within the ambit of the field of investigation of general metaphysics. General metaphysics simply abstracts from (leaves out of consideration, places aside) all those various distinctions (quidditative distinctions, generic and specific) which can be made between different kinds of objects and which might well serve as the bases for their differentiation and classification within the materially distinct subject-matters of other parts of philosophy and the other various sciences.

But, nonetheless, general metaphysics does have a proper and distinct subject-matter in that it considers all the objects and their peculiarities that enter within its scope (and all objects and their peculiarities enter within its scope) from a very particular point of view. That is, whilst general metaphysics does not have a materially distinct subject-matter it does have a *formally distinct* subject-matter. Whilst general metaphysics does not concern itself with all those peculiarities or features of objects which pertain to them insofar as they are objects of particular (generic and specific) kinds (and thereby materially

distinct subject-matters of other parts of philosophy and of other sciences) it considers all objects (no matter their particular kind) insofar as they are instances of *reality* - insofar as they are instantiations of the *ratio entis,* insofar as they are existing objects or entities, insofar as they are instances of *being.*

From this clearly follows, and becomes readily comprehensible, the classical and traditional definition of general metaphysics or ontology as the *science of being as being* (of *ens inquantum ens*): of being or reality considered precisely as such.

The consequent task of general metaphysics may accordingly be delineated in terms of the presentation of three principal concerns.

(i) The first and fundamental task of general metaphysics is the clarification of the meaning of being. The clarification of just what it is that all objects have in common insofar as they are entities, insofar as they are instances of being. This corresponds to the clarification of the content of the concept of being in general. This clarification of the concept of being in general involves as well the clarification of certain other fundamental metaphysical concepts which are discerned to be intimately connected with the concept of being. To give but a few examples: the concepts of substance and accident; the concepts of potency and act; the transcendental concepts of truth, goodness, unity and so on.

(ii) The second and consequent task of general metaphysics is the discernment of those fundamental principles and general laws which determine or govern objects precisely insofar as they are instances of being, the discernment of those fundamental principles and general laws which pertain to and affect the structure of reality as such. To give but two examples: the principles of identity and of causality or of sufficient reason.

(iii) The third task of general metaphysics is a reflexive one which focuses upon the nature of general metaphysics itself. It corresponds to the task of the elaboration of an appropriate method for general metaphysics. It attempts to deal with such issues as: What is the point of departure for metaphysics? By what kinds of intellectual procedures do we first attain and then clarify the content of the concept of being in general and other metaphysical concepts? Just how do we manage to discern and verify fundamental metaphysical principles and general laws?

It should be noticed that this third task and aspect of general metaphysics gradually developed, during the course of the elaboration

of the various rationalist metaphysical systems of the seventeenth century, into the separate philosophical discipline of epistemology or criteriology. At the very beginning of modern philosophy, for example in the works of Descartes and his contemporaries such as Gassendi and Marin Mersenne (1588-1648), this third aspect of general metaphysics is not as yet fully distinct from general metaphysics as a separate philosophical discipline but the problematic that it deals with is so at least implicitly.

(2) *Special Metaphysics* - consisting of various parts variously referred to as *rational psychology, natural theology* or *theodicy* (this last designation stemming from the title of Leibniz's famous polemical work directed against Pierre Bayle, the *Theodicée* published in 1710) and so on. Special metaphysics, unlike general metaphysics, is conceived as a discipline which is endowed with a subject-matter which is not only formally but also materially distinct from the subject-matter of other parts of philosophy. Special metaphysics deals with a particular kind of objects: special metaphysics deals with immaterial or *supersensible objects.* Special metaphysics deals with certain objects or entities which we affirm to exist and to be characterized by the possession of particular natures but of which we can never, and as a matter of principle, have direct knowledge by means of sense perception. For example: God and the other separated substances; the human soul.

Special metaphysics is founded upon, and represents the application to a particular set of objects (to the various kinds of immaterial or supersensible objects) of, the conclusions of general metaphysics. The fundamental metaphysical concepts which are clarified by general metaphysics, and the fundamental metaphysical principles and general laws which are discerned by general metaphysics as being determinative with respect to the structure of reality as such, are employed within special metaphysics so as to yield conclusions with respect to the existence and nature of, as a matter of principle sensuously unknowable, immaterial objects such as God and the human soul.

In a further moment special metaphysics will deal with those particular philosophical problems which inevitably arise from any attempt to understand the relationship which holds between the characteristics of the sensible universe which we grasp by sense perception and the various supersensible substances which are affirmed to exist and to be endowed with particular natures. For example, once the part of special metaphysics known as *natural theology* has concluded to the existence of a benevolent and omnipotent Supreme Being it cannot but

have to deal with such issues as the accordingly paradoxical presence of evil in the world and the accordingly paradoxical affirmation of the reality of human freedom.

II

It is now possible to return to our initial concern. How did medieval philosophy and modern philosophy, respectively and speaking very generally, conceive the relationship which they envisaged as holding between the disciplines of metaphysics and of the theory of knowledge? Let us consider each general position in turn.

(1) First of all, how did medieval philosophy conceive the relationship between metaphysics and the theory of knowledge? Very generally it can be said that the philosophers of the middle ages, and here I have in mind especially the great scholastic doctors of the thirteenth century, saw metaphysics as the theoretical foundation of, and hence as logically and systematically prior to, the theory of knowledge. Metaphysics arrives at certain fundamental concepts and general principles which are then applied so as to arrive at a theory of knowledge - so as to elaborate an understanding of the structures and functioning of the process of human cognition.

For example, the tradition of medieval Aristotelianism, represented by such thinkers as Albert the Great and Thomas Aquinas, would understand the process of human knowledge most fundamentally in terms of the theory of *abstraction*. This theory represents the application to the problem and study of the functioning and structures of the process of human cognition of certain previously clarified metaphysical principles such as the distinctions between potency and act, matter and form and, especially, the principle of the priority of act over potency.

To give another example, the tradition of medieval Augustinian Neo-Platonism, represented by such a thinker as Bonaventure, would understand the process of human knowledge (at least as far as its higher levels are concerned such as that of the knowledge of first principles) in terms of the theory of *illumination*. This theory represents the application to the problem and study of the functioning and structures of the process of human cognition of the received Neo-Platonist metaphysical principle of emanation.

In this context two points need to be stressed.

(i) Generally speaking, medieval theories of knowledge were essentially metaphysical and highly speculative interpretations of the

process of human cognition. Indeed they were so metaphysical and so daringly speculative as to not limit themselves to merely a consideration of the proces of human cognition but also to concern themselves with both angelic and divine knowledge. It ought not to be surprising then that, despite their initial concern with the factual process of human cognition and involving an important element of methodological introspectionism in this regard, medieval theories of knowledge were in no sense anticipations, let alone instances, of experimental psychology.

(ii) Once again generally speaking, the veracity of human cognition, the capacity or reliability of human knowledge with respect to the attainment of the truth, was rarely called in question by medieval theories of knowledge. Medieval theories of knowledge were in no sense anticipations, let alone instances, of authentic epistemology or criteriology.

How is one to account for this second general characteristic of medieval theories of knowledge? Now let us place aside various reasons of a purely contingent and historical character that one might appeal to as explanatory in this regard. For example, the lack of knowledge during the medieval period of the works of the various non-Aristotelian schools of ancient philosophy, such as Scepticism, which had seriously raised epistemological issues.

Rather, from a systematic or theoretical point of view, the principal reason which needs to be stressed seems to be quite simply that medieval philosophical systems (more precisely, philosophico-theological systems) were metaphysically *realist* systems. That is, these philosophical systems contained, as one of their fundamental presuppositions flowing from their very character as philosophico-theological systems, an implicit realist answer to any possible formulation of the epistemological problem. Consequently, the theories of knowledge presented by these philosophical systems would only deal with human knowledge from a statistical, rather than an epistemologically problematic, perspective. Hence we find no authentically epistemological treatises or discussions among the works of the great scholastics. It is not irrelevant to remark at this point that the contemporary neo-scholastic discipline of epistemology or criteriology is precisely as a discipline, and no matter how genuinely - or otherwise - ultimately Thomistic in inspiration and content, very much the product of the revival of scholasticism during the nineteenth and twentieth centuries and is in fact a somewhat belated reaction to the epistemological problematic as first raised by modern philosophy.

(2) In the second place, how did modern philosophy, once again very generally speaking, conceive the relationship between metaphysics and the theory of knowledge? Undoubtedly in a manner exactly opposite to that of medieval philosophy. For modern philosophy metaphysics could not be prior to and found the theory of knowledge at all. Rather, if metaphysics itself was to be possible at all it would itself have to be preceded by and founded upon an epistemologically satisfactory theory of knowledge to begin with. Thus for modern philosophy the elaboration of an epistemologically satisfactory theory of knowledge, carried out within the context of the famous *turn to the subject* so characteristic of the new philosophy of this period, has to precede the elaboration of any metaphysics whatsoever and indeed is wholly determinative, and this as a matter of principle, of the very possibility of the realization of any metaphysics at all.

Obviously such a satisfactory and determinative theory of knowledge, considered as an indispensable propadeutic to the very possibility of the elaboration of a metaphysics, would have to be much more than a mere, and no matter how sophisticated, speculative interpretation of the functioning and structures of the process of human cognition. It would have to be first and foremost an epistemology or criteriology concerned with the establishment of the validity, the reliability and speculative capacity and reach, of human cognition - of the cognitive faculties of sensibility and reason.

There is therefore a radical contrast between the ways that medieval and modern philosophies conceive the relationship between metaphysics and the theory of knowledge - a radical contrast which implies two very different conceptions of the nature and task of the theory of knowledge itself. Furthermore this radical contrast implies the taking place of a radical change in philosophy as it passed from its medieval to its modern manifestations. Clearly this radical change could not just have happened without any reason and the reason is in fact obvious: the emergence of the epistemological problem at the very dawn of modern philosophy, during the early decades of the seventeenth century, in an unprecedentedly momentous and pregnant manner.

III

The central issue which needs to be confronted at this point is that of precisely why did the epistemological problematic emerge for modern philosophy with such force as it had never done for medieval philosophy. Why precisely did epistemological preoccupations arise during the

opening decades of the seventeenth century in a previously unprecedented manner, with such a degree of intensity as to force philosophy to invert the relationship between metaphysics and the theory of knowledge that had been generally taken for granted during the middle ages and thereby giving rise to modern philosophy itself?

Here we need to indicate several important factors all of which contemporaneously came to exercise a determinative influence early in the seventeenth century:

(1) The decay of scholasticism.

(2) The rediscovery of the sceptical tradition.

(3) The emergence of the problem of the criterion in the religious context of the Counter Reformation.

(4) The development of the new heliocentric astronomy.

(5) The displacement of the old Aristotelian physics by the new quantitative physics and the consequent emergence of the mechanistic vision of the universe and the allied mechanical philosophy.

I shall now consider each of these factors in turn. In the remainder of the present section I shall present very summary considerations of the first four factors. In the next section the fifth factor will be considered in greater detail.

(1) *The Decay of Scholasticism.* The first factor that needs to be indicated as being at least partially responsible for the emergence of the epistemological problematic during the first few decades of the seventeenth century is the state of scholastic philosophy at this time. Some authors have spoken of this state of affairs as "the breakdown of the medieval synthesis." Nonetheless one must be cautious about accepting the interpretation of medieval thought implied by this expression as even during the golden age of scholasticism during the thirteenth century there had never been any one "medieval synthesis" but rather a pluralistic scenario of competing and highly diverse currents of thought. Let it simply be said that by the beginning of the seventeenth century the situation had reached an extreme point. There were at least six, to mention only the major ones, scholastic traditions in competition with one another: traditional, Dominican, Thomism; Scotism; Durandism; the *via moderna* of Ockham and the other *nominales;* the post-Tridentine scholasticism characteristic of the Jesuit Order and particularly associated with its two great centres, the Roman College and the

University of Coimbra with its famous commentators on Aristotle - the *Conimbricenses;* the post-Tridentine scholasticism characteristic of the Discalced Carmelite Order and particularly associated with its colleges at the universities of Alcala and Salamanca and their famous commentators on Aquinas - the *Complutenses* and the *Salmanticenses.*

Well before the beginning of the seventeenth century this situation had commenced to provoke rather negative reactions. The interminable disputes, the total inability to find any point of agreement, the at least seeming vacuousness of these disputes, the seemingly pointless character of the debates, their sterile formalism, made many think that there was a real need to start again and to do so from the beginning. And, to avoid a repetition of the same situation, to build this time upon more secure foundations - upon foundations with respectable epistemological credentials.

It should be remarked, nonetheless, that late scholasticism did not influence the early development of modern philosophy exclusively in the manner of provoking negative reactions. In this regard the most influential of the various scholastic currents just mentioned would be that of Jesuit scholasticism and this especially through the works of its most important representative Francisco Suarez (1548-1617). Many of the great philosophers of the seventeenth century did have a serious knowledge of late scholastic philosophy and did so especially in virtue of their acquaintance with Suarez's *Disputationes Metaphysicae* first published in 1597. Indeed from Suarez modern philosophy would inherit a number of common place scholastic distinctions and some significant, ultimately nominalist, epistemological theses which would exercise a considerable influence on its development. But I shall not deal with this matter in the present context.

(2) *The Rediscovery of the Sceptical Tradition.*[2] The rediscovery and the publication in Latin translation of classical texts presenting the epistemological discussions of the Greek sceptical tradition, both Academic and Pyrrhonian, during the second half of the sixteenth century focused attention on the shortcomings of the Aristotelian and scholastic accounts of human cognition. These accounts which had previously been generally accepted as fundamentally unproblematic came to be seen as presenting an interpretation of human knowledge which was unreliable both from the point of view of the sense perception upon

[2]See: POPKIN, Richard H., *A History of Scepticism from Erasmus to Spinoza,* Berkeley: University of California Press,1979.

which it supposedly was grounded and from that of purely intellectual knowledge with its claim to a knowledge of real essences. Especially important in this regard were the works of Sextus Empiricus, *Pyrrhoniarum Hypotyposeon libri III* (1562) and *Adversus Mathematicos . . . libri XI* (1569). One should note that the rediscovery and publication of the works of Sextus Empiricus gave rise, it has been argued, to the development of a veritable current of sceptical thinkers, the "Nouveaux Pyrrhoniens", represented especially by Michel de Montaigne (1533-1592) and Pierre Charron (1541-1603). A current of sceptical thinkers which would bequeath to the seventeenth century a sceptical crisis to which the founders of modern philosophy, such as Descartes and Gassendi, would attempt to respond.

(3) *The Problem of the Criterion in the Religious Context of the Counter Reformation.*[3] It must be stressed that the impact of the late sixteenth century rediscovery of Greek scepticism turned out to be as momentous as it did because it occurred within an intellectual context which had already anticipated a concern with its central epistemological problematic and especially with the issue of the criterion of truth. This was the context of the interminable religious controversies associated with the Protestant Reformation and the Catholic Counter Reformation. The central thematic can be presented quite summarily. The Protestant Reformation had effected what might be described as an "epistemological revolution" within Christianity by replacing as the rule of faith, as the criterion of religious truth, the traditional Catholic appeal to the authority of Tradition, Conciliar and Papal Teachings with an appeal to the conscience of the individual believer involved in a sincere attempt to understand Divine Revelation as it appeared in the inspired texts of Holy Scripture. But just how, by means of what standard or further criterion of truth, was one to be able to choose between these two alternative rules of faith or criteria of religious truth - and avoid viciously circular reasoning at the same time? It is easy to see that the extension of this epistemological conumdrum from the field of religious belief to that of natural knowledge corresponds perfectly to the emergence of the problem of the criterion of truth as formulated by the sceptical tradition. If we are to discriminate truth from falsity then we need a criterion of truth. But then on what basis is it possible to discriminate between true and false criteria of truth? Just how is it possible to arrive at an ultimate criterion of truth and avoid both an

[3]See: POPKIN, Richard H., *op. cit.*, Chapter I.

infinite regress and circular reasoning as well as any kind of purely arbitrary, capricious, choice of a criterion?

(4) *The Development of the New Heliocentric Astronomy.*[4] Associated with the rise of the new quantitative physics, as an inseparable and reciprocally conditioning factor, was the development of the new heliocentric astronomy. This involved the replacement of the traditional, Aristotelian and Ptolemaic, geocentric conception of the universe with the heliocentric conception of the universe first proposed in modern times by Nicolas Copernicus (1473-1543) with the publication of his *De Revolutionibus Orbium Coelestium* in 1543. The subsequent development of modern astronomy would reach its climax with the mathematical interpretation of the dynamism of the heliocentric system in terms of the laws of universal gravitation presented by Isaac Newton (1642-1724) in the *Philosophiae Naturalis Principia Mathematica* of 1687. The development of modern astronomy itself contributed to an intensification of the preoccupation of modern philosophy with epistemological issues insofar as it forced man to question and reevaluate his position in the cosmos, a position which he had previously taken for granted as being central, and thus to refocus his attention upon himself and his peculiarities as a knowing subject.

IV

(5) *The Rise of the New Physics.*[5] The development of the new quantitative physical science which by the end of the seventeenth century had completely displaced the old, Aristotelian, qualitative physics represents the central element of the scientific revolution of the sixteenth, seventeenth and eighteenth centuries. This scientific revolu-

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[4]See: KUHN, Thomas S., *The Copernican Revolution,* Cambridge Mass.: Harvard U.P., 1957.

[5]See: BURTT, E. C., *The Metaphysical Foundation of Modern Science,* London, 1925; WOLF, A., *A History of Science, Technology and Philosophy in the 16th and 17th Centuries,* London, 1935; HALL, R. H., *The Scientific Revolution,* London, 1954; KOYRE, A., *From the Closed World to the Infinite Universe,* Baltimore, 1957; COHEN, I. B., *The Birth of a New Physics,* Garden City, 1960; DIJKSTERHUIS, E.J., *The Mechanization of the World Picture,* Oxford, 1961, JONES, R. F., *Ancients and Moderns,* St. Louis, 1961. BUTTERFIELD, H., *The Origins of Modern Science,* London, 1962; HALL, R. H., *From Galileo to Newton,* New York, 1963; KOYRE, A., *Metaphysics and Measurement: Essays in the Scientific Revolution,* Cambridge, Mass., 1965; BUCHDAL, G., *Metaphysics and the Philosophy of Science. The Classical Origins: Descartes to Kant,* Oxford, 1969; WESTFALL, R. S., *The Construction of Modern Science,* New York, 1971; WESTFALL, R. S., *Science and Religion in Seventeenth Century England,* Ann Arbor, 1973; LOSEE, J., *A Historical Introduction to the Philosophy of Science,* Oxford, 1980.

tion was largely achieved during the lifetimes of its two most famous protagonists, Galileo Galilei (1564-1642) and Isaac Newton (1642-1724).

The question of the origins and causes of the development of the new physics, and of the scientific revolution in general, is a very complex one. Among the many factors which could be discussed the following deserve a special mention: -

(i) The rediscovery of nature and of man's place in nature characteristic of the humanism of the Renaissance.

(ii) The rediscovery of ancient non-Aristotelian philosophers especially those of Pythagoras and of the Neo-Platonic tradition and the classical atomism of Democritus, Leucippus and Epicurus.

(iii) The rediscovery, translation and publication of ancient scientific treatises, especially the works of Euclid and Archimedes.

(iv) The highly original, and often extremely esoteric, philosophies of nature elaborated by such sixteenth century thinkers as Bernardino Telesio (1507-1588), Francesco Patrizi (1529-1597), Giordano Bruno (1548-1600) and Tommaso Campanella (1568-1639).

(v) The original contributions to the development of physical science made by the scholastic tradition. For example, the theory of *impetus* elaborated during the fourteenth century by a group of scholars associated with Merton College, Oxford, and, after these, by the Parisian School of John Buridan (*ob. ca.* 1360) and Nicholas Oresme (1320-1382).

(vi) The contribution made to the development of physical science, and especially to the discussion and refinement of scientific methodology, by members of the secular (often Averroistic) Aristotelian tradition associated with the Italian Universities of Padua, Bologna, Pavia, Pisa, Ferrara . . . One should be aware of the important circumstance that in these academic contexts the Aristotelian *corpus* of philosophical and scientific treatises was studied as a propadeutic not to the study of theology (as, for example at the universities of Paris and Oxford) but to the study of medicine.

(vii) The programmatic advocation of the inductive and experimental method as well as of the empirical discipline of *natural history* in the works of Francis Bacon (1561-1626).

The interplay of all of these factors, without entering into the matter of details let alone the complex issue of their relative importance,

can be said to have contributed, at the very least in the sense of preparing a welcoming context, to making possible the distinctive and highly original contributions of the great scientists of the seventeenth century.

But before turning to, and in order to be able to properly appreciate, the characteristics of the new quantitative physics it will be useful to indicate some of the characteristics of the old qualitative physics that it displaced, of the Aristotelian physics of the scholastics whose basic sources were the works of the Aristotelian *corpus* which deal with natural science in the sense of a philosophy of inanimate nature: *VIII Physicorum; De Generatione et Corruptione; Metereologica; De Coelo* . . .

(i) The qualitative Aristotelian physics is a radically empirical (in the sense of *experiential*) physics. It finds its point of departure in the direct and supposedly unproblematic perceptual observation of nature. That is, it relies upon sense perception the reliability of which is taken for granted and the direct objects of which, the sensible qualities, are interpreted realistically - that is, as real accidents inhering in or adhering to substances as their subjects. Therefore it is to be characterized as being a *qualitative physics.*

(ii) At the same time, it is a *rational,* in the sense of speculative or philosophical, physics. It seeks definitive explanations of the natures or essences (and consequently of the necessary patterns of behaviour) of natural phenomena (of sensible substances and their properties) by means of reasoning from philosophical (and ultimately metaphysical) principles and concepts such as those of substance, accident, form, matter . . .

(iii) The Aristotelian physics is therefore conceived of, in the first place, as a search for ultimate explanatory causes: material; formal (or essence - *ousia* in the sense of *to ti en einai*); efficient; final. The explanation of natures and of the consequent necessary patterns of behaviour of natural phenomena takes the form of reasonings from and to the discernment of these causes. It is a reasoning which seeks to explain just *why* natural phenomena are what they are and consequently why natural phenomena behave, and *must* behave, in the manner that they do actually behave. It is a reasoning which seeks to account for the fact that certain predicates (essential properties), universally and necessarily, pertain to certain objects (substances) which can accordingly be classified as belonging to certain *natural kinds* - as falling within the extension of certain generic and specific

concepts formed by a process of abstraction which has its point of departure in the operation of sensibility. This causal reasoning in natural science or physics may take the form of demonstrations, either *quia* (from effects to cause) or *propter quid* (from cause to effects).

(iv) The proper object, or direct subject-matter, of physics, of natural science, are natures or essences (formal causes) instantiated in sensible, mutable and contingent, spatio-temporally determined particulars. These are known through universal concepts which are formed by the mind as the result of the process of abstraction and which as such, as universals, exist only in the mind. Natural science is concerned with a determinate and essentially fixed and unchanging structure: the pattern of immutable, necessary and universal, natures which are realized in the changing, contingent and material, particular entities which are the constituents of the spatio-temporally determined sensible world - the realm of *physis* - and which are only indirectly the subject matter of physics. Therefore natural science is a genuinely scientific discipline which fulfills the Platonic ideal of *episteme.*

(v) As its very name indicates natural science, or physics, is concerned especially with the essential, unchanging and necessary, characteristics of the realm of *physis* or emergent nature. Now the principal characteristic of the sensible world is precisely that of change or *motion.* This is understood though not merely in the narrow sense of local motion but, metaphysically, in its widest sense as a transition from potency to act.

(vi) Aristotelian science accordingly recognizes different species of motion as being operative within the different categories which divide natural reality:

(1) In the category of substance: substantial change, that is, generation and corruption.

(2) In the category of quality: alteration.

(3) In the category of quantity: augmentation and diminution.

(4) In the category of place: local motion.

One should note that the species of motion which are operative in categories other than that of substance are instances of *accidental* change, that some categories (relation, action and passion) do not directly admit of motion and that the category of time represents a condition of motion.

(vii) The phenomenon of local motion in the sublunary sphere is explained in terms of the doctrine of the four elements (earth, water, air, fire) and their characteristic combinations of contrary qualities (hot, cold, wet, dry). Each of the four elements has its *natural place* in the cosmos. Local motion is consequent upon the disturbance of one or other of these elements from its natural place and represents that element's tendency to return to its natural place in accordance with its intrinsic qualities. Earth and water are intrinsically heavy (they are endowed with the intrinsic quality of *gravity*) and therefore their natural motion (back to their natural place in the universe) is a downward one towards the centre of the cosmos. Air and fire, on the other hand, are intrinsically light (they are endowed with the intrinsic quality of *levity*) and therefore their natural motion (back to their natural place in the universe) is an upward one away from the centre of the cosmos. A fifth element, the ether or celestial stuff, which is the "matter" of the superlunary celestial spheres of the Aristotelian-Ptolemaic cosmos has special qualities of perfection so that accordingly its natural motion is circular motion around the centre of the cosmos. One should particularly notice in this context that, at least as far as the four sublunary elements are concerned, their natural motion (their tendency to return to their natural place in accordance with their intrinsic qualities) is conceived to be ultimately due to some disturbance and as such is considered to be something fundamentally *unnatural*. The natural, normal, state of material bodies is not considered to be local motion at all but *quies*, rest.

(viii) Aristotelian physics rejects any kind of corpuscular theory of matter. In line with Parmenides Aristotle affirms that matter is continuous quantity (a *plenum*). Ultimately, matter is interpreted metaphysically as *prime matter*, as a pure capacity for determination or potentiality. As such, of course, it is never to be actually encountered or capable of being observed. It is simply postulated on philosophical grounds so as to provide the process of substantial change, of generation and corruption, with a principle of continuity. As matter is only potentially infinitely divisible there is no actual infinite in nature. As matter is a continuous quantity there are no atoms and there is no void.

As mentioned already the scientific revolution of the seventeenth century had as its central element the displacement of the Aristotelian qualitative physics through the elaboration of a new physics, a new quantitative natural science. Inaugurated by the work of Galileo and his contemporaries it would reach perfection in Newton's *Principia*. Let us now indicate, in a manner which parallels as closely as possible our

presentation of the essential themes of Aristotelian physics, the salient characteristics of the new physics.

(i) Perhaps paradoxically at first sight, the new physics in fact is not as radically empirical (in the sense of *experiential*) as the old qualitative physics. This is because it does not find its point of departure in any direct and supposedly unproblematic, but actually naive, observation of nature. That is, it does not commence by taking for granted the reliability of sense perception nor the interpretation of its objects (the sensible qualities) in a naively realistic sense. This epistemological sophistication on the part of the new physics might well be connected with the influence of the rediscovery of the ancient sceptical tradition which occured, as we saw above, towards the end of the sixteenth century.

(ii) Nonetheless, the new physics is characteristically an experimental physics. That is, its investigation of nature becomes increasingly dependent upon experience in the sense of experimentation - in the sense of *controlled observation.* One should be aware in this context of the increasingly important role which would be played in scientific research throughout the seventeenth century by newly invented scientific instruments. One might well conjecture that the central place attributed to controlled observation by the new physics, especially in the case of Galileo and his disciples, could have been the result of the influence exercised by the recently rediscovered Archimedean scientific tradition.

(iii) The method of experimentation, of controlled observation, so characteristic of the new physics is directed towards progress in scientific research. Its aim is scientific discovery. The new physics has as its central concern the discovery of new, previously unknown, truths about natural phenomena. Hence the impatience of the leading protagonists of the scientific revolution, and of the philosophers ideologically allied with them, with classical, Aristotelian, formal logic. This traditional logic in no way seemed to be a logic of scientific discovery and as such was deemed to be at the most of pedagogical utility with respect to the exposition and imparting of truths already known.

(iv) The new scientific methodological approach takes the form of the *hypothetico-deductive method.* Theory-laden experimentation, the controlled observation of nature carried out in the light of the speculative insights which are characteristic of the scientific genius, induces the scientist to formulate general hypotheses. From these general hypotheses are then *deduced* certain particular consequences

which can be tested by means of further controlled observation. Once repeatedly corroborated on the basis of this further controlled observation of their particular consequences (that is, scientific predictions) the general hypotheses in question are deemed to have been confirmed. They are then accorded the status of scientific theories and are recognized as being somehow expressive of the laws of nature themselves.

(v) It should be stressed that the initial general hypotheses, as well as the subsequent scientific theories or laws arrived at when these initial general hypotheses are deemed to have been confirmed by repeated corroboration, are formulated mathematically - they are usually expressed in the form of a mathematical function. The testing, by means of controlled observation, of the particular consequences deduced from the initial general hypotheses and which leads to their eventual acceptance as scientific theories or laws, accordingly takes the form of the *measuring* of the behavioural pattern of the natural phenomena being considered. Therefore the new physics limits itself to the investigation of what *can be tested in this manner,* of what is amenable to mathematical treatment - of what is measurable. The new physics is thus a *quantitative physics.*

(vi) Insofar as it is a quantitative physics which limits its consideration to the measurable the new physics does not seek ultimate explanations but solely true descriptions of the behavioural patterns of natural phenomena (that is, of bodies in motion). It does not seek metaphysical accounts of natures or essences through the investigation of causes and, indeed, dismisses any such attempt as misguided. If natural phenomena do have ultimate natures or essences (what Locke would call *real essences* as opposed to *nominal essences*) they might be known by God but certainly not by men. Here we see the presence of not only the rejection of decadent scholasticism but, and once again, the influence of the epistemologically critical import of the rediscovered sceptical tradition. Consequently we have on the part of the new physics the wholesale rejection of any kind of appeal to metaphysical principles such as the notions of essence, substantial and accidental forms, final causality. These are all dismissed as *occult qualities* the appeal to which, far from resulting in an explation of natural phenomena, produces no more than obfuscating circumlocutions.

(vii) The universe is conceived by the new physics as a mechanical system. It is envisaged as a large machine which is a system of bodies in motion. The behavioural patterns of these bodies in motion is deemed

to be regulated by natural laws which can be discovered in scientific research by means of the mathematical measurement of these behavioural patterns. Accordingly all physical change is reduced to the category of local motion and local motion comes to be seen as the *normal* state of bodies (this is the point of the *law of inertia*). The fundamental law of the new physics is the law of the *fall* (relatively not absolutely) of heavy bodies near the surface of the earth as first formulated by Galileo in terms of uniform acceleration. All physical causality is reduced to efficient causality. That is, all physical causality is interpreted as being some form of contact (impact, collision, shock) between two bodies in motion.

V

Closely allied with the new conception of physical science as a mechanics (dynamics and statics) and of the physical world as a mechanical system were a number of quasi-scientific, indeed philosophical, perspectives and implications which, nonetheless, must be kept rigorously distinct from the properly scientific content of the new physics as just delineated. I should like to stress three of these philosophical theses which would come to play central roles in the history of the development of modern philosophy.

(i) The mechanistic conception of the universe had the possibility of being interpreted as being not only a scientific position (for example, in an exclusively instrumentalist sense) but a philosophical position as well. If the mechanistic conception of the universe is accordingly interpreted to be a philosophical position which affirms that the mechanistic conception expresses the way that the cosmos really is in itself than this mechanistic conception becomes something more than a merely scientific hypotheses or even theory, it becomes a *metaphysics of nature.* As such it is founded upon the philosophical conviction that the universe is best understood by a physics conceived as an experimental mechanics and as a mechanistic system because the universe is intrinsically a mechanical system of bodies in motion - a system of bodies in motion which is endowed with an intrinsic intelligibility because it is *essentially mathematical in nature.*

Now, this philosophical position, the interpretation of the mechanistic conception of the universe as a metaphysics of nature, clearly goes well beyond what is required by the new physics itself. The new physics itself as a quantitative experimental mechanics is just as susceptible to

a purely mathematico-phenomenalist, instrumentalist, interpretation. That is, one could well look upon the new physics as being simply and no more than the most convenient and efficient instrument available for the study and control of nature without raising it at all to the status of a metaphysics of nature which claims to grasp nature as it is in itself. As a matter of fact not all advocates of the new physics, of the "experimental philosophy", were willing to accord to the concomitant mechanistic conception of the universe the status of a metaphysics of nature. Those who did so went beyond mere physics and became obviously the advocates of a philosophical position, of a metaphysics, that came to be known as the "mechanical philosophy".[6]

(ii) A second characteristic philosophical implication of the new physics was the distinction between primary and secondary qualities. *Secondary qualities* (corresponding roughly to the "proper sensibles" of scholasticism) such as heat, sound, flavour, odour and colour are considered to be merely subjective phenomena. They are deemed to be no more than impressions caused by the motion of bodies external to and affecting sensible consciousness by the stimulation of the sense organs. Clearly there can be no question of these subjective appearances in any way resembling the way that external bodies are in themselves. *Primary qualities* (roughly corresponding to the "common sensibles" of scholasticism) such as extension and its properties and motion and its properties are, on the other hand, considered to be objective insofar as they are amenable to mathematical treatment, to measurement. They are known by reason alone and the ideas that the mind forms or already has of them represent things as they are in themselves.

(iii) A further characteristic philosophical implication of the new physics was the *corpuscular theory of matter.* This theory affirms that the bodies in motion which ultimately constitute the machinistic universe and which are the elementary constituents of matter are corpuscules or particles. This theory of matter became dominant in the seventeenth century but it did so in the form of two alternative versions. According to the first version the corpuscules which are the ultimate constituents of matter are *infinitely divisible.* Therefore matter has to be acknowledged as being a continuous quantity or *plenum.* Insofar as matter is a continuous quantity there can be neither atoms nor the void. Motion is accordingly accounted for by theories such as the Cartesian theory of vortices. According to the second version the corpuscules

[6]See: LENOBLE, R., *Mersenne ou la Naissance du Mécanisme,* Paris: Vrin, 1943; BOAS, M., "The Establishment of the Mechanical Philosophy," *Osiris,* X (1952), 412-541.

which are the ultimate constituents of matter are *not infinitely divisible.* Therefore matter has to be acknowledged as being a discrete quantity. As there must be ultimately indivisible corpuscules there are atoms and there is the void. Motion is accordingly accounted for as taking place through the void.

Let us now return to the issue which was first raised at the beginning of section III above. In what way can the displacement of the old qualitative physics by the new quantitative physics, as well as the implications of this change, be seen as contributing to the emergence of the epistemological problematic with particular intensity for the philosophers of the opening decades of the seventeenth century? The answer is surely to be seen in the need on the part of the new physics for philosophical grounding and justification. Accordingly the provisioning of the new physics with unshakeable philosophical foundations, with epistemologically incontrovertible foundations which would both protect it in its infancy against the scholastic defenders of the old physics and defend it from the critical reach of the recently rediscovered sceptical tradition, became the principal vocation of those philosophers of the first half of the seventeenth century whom now, looking backwards, we acknowledge as the originators of modern philosophy.

VI

Indeed, we find all of the five factors mentioned in section III above as being responsible for the emergence of the epistemological problematic at the dawn of the seventeenth century coming together in the preoccupations and work of Rene Descartes. We also find all of these factors coming together in the preoccupations and work of Descartes' contemporary, and at different times both friend and great antagonist, Pierre Gassendi. Yet, and this must be stressed, all of these identical factors come together in these two founding fathers of modern philosophy with remarkably different consequences. This, to the extent that we might well look upon Descartes and Gassendi as the originators of the two epistemological currents in modern philosophy of *rationalism* and *empiricism* respectively. To see this let us summarily consider each of these two founders of modern philosophy separately.

(i) *Descartes.*[7] Without entering into any kind of discussion I shall simply indicate what are generally recognized to be the central themes

[7] See: (This is but a selection of the more important recent works in English) SMITH, N. K., *New Studies in the Philosophy of Descartes,* London: Macmillan, 1952; BECK, L. J., *The Method of Descartes, a Study of the Regulae,* Oxford: O.U.P., 1952; BECK, L. J., *The*

of the Cartesian problematic. (i) A marked dissatisfaction with the then current scholastic philosophy, due to its endless disputes and seeming sterility, leading to a recognition of the need to commence entirely anew. (ii) The desire to do away, once and for all, especially with the useless scholastic qualitative physics. (iii) A great admiration for the then newly developing quantitative physics and a desire to contribute to its further progress. (iv) The desire to elaborate an adequate philosophical foundation for the new quantitative physics. (v) The desire to elaborate an adequate epistemological defence for the new physics which would enable it to withstand the critical import of the then recently rediscovered sceptical tradition.

The resolution which represents the Cartesian response to the interplay of these factors is well known. The decision to begin entirely anew, to elaborate a securely grounded metaphysics. This meant, for Descartes, the attempt at elaborating a metaphysics which would be *methodologically* akin to mathematics. That is, ultimately, a metaphysics structured as an axiomatic-deductive science patterned on the structure of Euclid's *Elements*. A metaphysics which would find its point of departure in the smallest possible number of indubitable axioms from which its entire content, as well as the entire content of all other human sciences supposedly grounded upon it, could be deduced following the *order of reasons,* the way of clear and distinct ideas.

But this project, which would be realized in the *Meditationes de Prima Philosophia,* 1641, implied precisely the problem of finding the required apodictic or indubitable point of departure for this metaphysics envisaged as the foundation of all scientific knowledge. It is well known, once again, that Descartes resolved this problem by means of a strategy which involved an attempt to out-flank scepticism by going further than scepticism itself - the methodology of radical systematic doubt which would climax in the intuitive grasp of the apodicticity necessarily affecting the existential judgment concerned with the *cogito.*

Metaphysics of Descartes, a Study of the Meditations, CRONIN, T. J., *Objective Being in Descartes and in Suarez,* Rome: Gregorian U.P., 1966; KENNY, A., *Descartes,* New York: Random House, 1968; FRANKFURT, H., *Demons, Dreamers and Madmen,* Indianapolis: Bobbs-Merrill, 1970; CATON, H., *The Origin of Subjectivity, an Essay on Descartes,* New Haven: Yale U.P., 1973; REE, J., *Descartes,* London: Allen Lane, 1974; CURLEY, E. M., *Descartes against the Sceptics,* Cambridge, Mass.: Harvard, U.P., 1978; WILLIAMS, B., *Descartes, the Project of Pure Enquiry,* Sussex: Harvester Press, 1978; WILSON, D.M., *Descartes,* London: Routledge & Kegan Paul, 1978; CLARKE, D., *Descartes' Philosophy of Science,* Manchester: Machenster U.P., 1982; GRENE, M , *Descartes,* Minneapolis, MN: U. of Minnesota P., 1985; GUEROLT, M., *Descartes' Philosophy Interpreted According to the Order of Reasons,* 2 vols. (Tr. R. ARIEW), Minneapolis, MN: U. of Minnesota P., 1985;; COTTINGHAM, J., *Descartes,* Oxford: Blackwell, 1986.

The point that needs to be stressed in the context of the present discussion is that thereby Descartes raised the epistemological problem in a singularly pregnant manner. By doing so he inaugurated modern philosophy insofar as this step involved the at least implicit affirmation that the very possibility of metaphysics is dependent upon the prior elaboration of an epistemologically adequate theory of knowledge within the context of a reflexive turn of the knowing subject upon itself and its conscious contents.

(2) *Gassendi.*[8] Once again without entering into any kind of discussion I shall simply indicate what are generally recognized to be the central themes of the Gassendist problematic. What is striking is their very identity with the central themes of the Cartesian one. (i) A marked dissatisfaction with the then current scholastic philosophy, due to its endless disputes and seeming sterility, leading to a recognition of the need to commence entirely anew. (ii) The desire to do away, once and for all, especially with the useless scholastic qualitative physics. (iii) A great admiration for the then newly developing quantitative physics and a desire to contribute to its further progress. (iv) The desire to elaborate an adequate philosophical foundation for the new quantitative physics. (v) The desire to elaborate an adequate epistemological defence for the new physics which would enable it to withstand the critical import of the then recently rediscovered sceptical tradition.

The Gassendist project which represents his response to the interplay of these themes is not as well known as the Cartesian one. Until very recently, and especially in English-speaking contexts, Gassendi has been generally neglected and has not received the attention that he undoubtedly deserves. This has been rather unfortunate because an awareness of the very striking differences between the Gassendist and the Cartesian responses to the identical problematic enables one to have a far more accurate and balanced picture of the emergence of modern philosophy than when, as is usually the case in this regard, one focuses upon Descartes alone.

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[8]See: (This is a list of monographs in English only) BRETT, G. S., *The Philosophy of Gassendi,* London: Macmillan, 1908; JONES, H., *Pierre Gassendi, 1592-1655: an Intellectual Biography,* Niewkoop: De Graaf, 1981; EGAN, H. T., *Gassendi's view of knowledge: a study of the epistemological basis of his logic,* Lahnam, MD: U. P. of America, 1984; PANCHERI, L. U., *The Atomism of Pierre Gassendi, Ontology for the New Physics,* Ann Arbor: U. Microfilms Int., 1982; BRUNDELL, B., *Pierre Gassendi. From Aristotelianism to a New Natural Philosophy,* Dordrecht: Reidel, 1987; JOY, L. S., *Gassendi the Atomist: Advocate of History in the Age of Science,* Cambridge: O.U.P., 1987.

Furthermore, and this is a point into which I cannot enter in the present context but which is of such great importance that it certainly warrants at least a mention, an awareness of the striking differences between the Cartesian and the Gassendist projects is not merely of historical interest. Indeed it raises the important issue of the nature of Western philosophy itself and of the form that it ought to take in the future. It raises the issue of whether the discipline of philosophy ought to harbour foundationalist ambitions or whether, and as a matter of principle, it should abandon such ambitions and strive for other, more pragmatic and dialogical, modes of contributing to the cultural progress of humanity.[9]

Unlike Descartes Gassendi basically accepted the fundamental conclusion of the then recently rediscovered sceptical tradition as to the impossibility of any kind of absolute or ultimate philosophical knowledge. Accordingly Gassendi elaborated an epistemological project which involved an attempt to tone down the practical import of this fundamental conclusion by means of the elaboration of a mitigated version of scepticism. Gassendi advocated an epistemological perspective which stressed that whilst it recognized the impossibility of absolute, metaphysical knowledge that nonetheless it also recognized the acquisition of *some* knowledge to be possible. This knowledge, and its primary example was provided according to Gassendi by the newly developing quantitative physics itself, was certainly no more than knowledge of phenomena, of mere appearances and not of reality in itself, but nonetheless was more than adequate to meet all of mankind's needs.

It is not surprising therefore that Gassendi completely rejected the Cartesian project and its ideal of an ultimate, *a priori* and deductive, metaphysics founded upon indubitable principles discovered by means of the characteristic steps of the Cartesian methodology of radical doubt and reflexion upon the knowing subject itself. As far as Gassendi was concerned the Cartesian methodology conflicted with common sense and indeed had a touch of the absurd about it whilst the Cartesian conception of metaphysics was no more than a relapse into the vain aspirations to absolute knowledge of the essences of phenomena which had previously characterized, and had resulted in the scientific sterility of, scholasticism.

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[9]See RORTY, R., *Philosophy and the Mirror of Nature,* Oxford: Blackwell, 1980.

For Gassendi therefore the new quantitative physics did not need any kind of ultimate metaphysical grounding in the Cartesian sense. The new physics simply provided its own epistemological justification insofar as its results were clearly derived from sense experience by means of controlled observation - results whose truth with respect to appearances were unquestionably guaranteed by the new physics' evident success at scientific prediction and at extending man's control over nature. Nonetheless, despite the new physics' pragmatic self-justification, philosophy, according to Gassendi did still have something to offer to the new physics. But this would not take the form of any kind of foundationalist project but rather it would take the form of that kind of *historical justification* that Gassendi sought to present in, and indeed which motivated, the carrying out of, his multidimensional project of rehabilitating the atomistic philosophy of Epicurus. A project which, after labouring through a multiplicity of versions and being impeded by a variety of distractions including his own vast erudition, Gassendi finally brought to fruition in the *Syntagma Philosophicum* which would be published posthumously in 1658.

Just how are we to account for the fact that the Cartesian and the Gassendist projects, even though they are both responses to the one and the same problematic, display such striking differences? This, of course, is a complex issue and to do justice to it one would have to enter into such different matters as their different personalities, their different intellectual psychologies. One would have to consider their different educational backgrounds and their strikingly different intellectual ideologies - one would have to contrast Descartes the mathematician with Gassendi the humanist. In the context of our present discussion one point though seems to be especially important. This is the fact that whilst both greatly admired the newly developing quantitative physics each seems to have been particularly impressed by a different aspect of it. Descartes seems to have been especially impressed by the mathematical aspect of the new quantitative physics whilst Gassendi seems to have been especially impressed by its empirico-observational aspect. The consequences of these different attitudes for their respective projects are strikingly evident.

In conclusion it should be stressed that, despite the striking differences between the Cartesian and the Gassendist projects, they do have something in common. This is the conviction which is to be found in Gassendi just as much as in Descartes that the very possibility of metaphysics is dependent upon the prior elaboration of an epistemologi-

cally adequate theory of knowledge. Their subsequent very different conclusions as to the possibility of metaphysics and its very nature is in this precise context really besides the point. What is at issue is their common radical break with medieval philosophy insofar as they both invert the traditional manner of conceiving the relationship between metaphysics and the theory of knowledge. Accordingly, Gassendi, just as much as Descartes is to be recognized as a founder of modern philosophy.

VII

In the preceding section it was suggested that Descartes and Gassendi might well be considered the originators of the two epistemological perspectives dominant in modern philosophy at least up to the time of Immanuel Kant (1724-1804) - *rationalism* and *empiricism* respectively. Although it is not possible in the present context to enter into the details of this matter let it be said that the two corresponding philosophical currents became increasingly distinct and reciprocally antagonistic during the subsequent course of the seventeenth century. What must be stressed is that in the last resort the formation of these two conflicting epistemological currents is itself to be seen as the consequence of, as a philosophical response to, the development of the new quantitative physics. Let us consider this point a little more closely.

I would suggest that, ultimately, the formation of the two epistemological currents of rationalism and empiricism is to be seen as representing two different responses to a single question. The question is: "What kind of theory of knowledge is possible when the realization of a theory of knowledge cannot be founded upon a previously elaborated metaphysics but is itself supposed to determine the very possibility of metaphysics?" Let us call to mind at this point that we have already seen that the conviction that the theory of knowledge must precede and ground metaphysics (that is, the distinctive characteristic of modern philosophy which differentiates it, and constitutes the basis of its radical break, from medieval philosophy) was itself a response to the emergence of the epistemological problematic at the beginning of the seventeenth century - an emergence very largely, if not exclusively, due to the philosophical implications of the then newly developing quantitative physics.

Now, just what is it that will determine the kinds of answer that might be given to this question as to the kind of theory of knowledge which will be possible without relying upon a previously elaborated metaphysics? Surely, at least ultimately, the determinative factor in

this regard will be one's convictions as to the nature of man, as to the nature of the knowing subject. But just how does this issue of the nature of man enter into the scene of modern philosophy to begin with? It is precisely with respect to this point that we must appreciate the impact made by the new quantitative physics insofar as it implied a particular conception of the universe - the mechanistic conception of the universe.

As has been already mentioned in a preceding section the mechanistic conception of the universe is that of a system of bodies, ultimately of corpuscules, in motion. The patterns of behaviour of these bodies can be measured so that the entire system can be understood mathematically and its properties can be formulated in terms of mathematical functions which are considered to be expressive of the laws of nature. These laws of nature are essentially laws of efficient causality and are entirely deterministic in character - hence the success of the new physics with respect to scientific predictions. The issue of the nature of man, of the nature of the knowing subject, emerges in the context of modern philosophy precisely in the form of the problem of the place or status of man with respect to the mechanistic universe.

It is this issue, with all its ethical and political ramifications, that during the course of the seventeenth century becomes the central problem of modern philosophy. Is man, or is man not, a part of the mechanistic universe? Is man "inside" the mechanistic universe, just one more body or aggregate of corpuscules in motion wholly determined by the laws of mechanistic causality, or is man "outside" the mechanistic universe, an essentially spiritual being who transcends the material universe and is endowed with freedom and moral responsibility and is accordingly only subject to the teleological laws of morality?

Clearly, which one of these two alternatives is accepted will determine entirely the answer that will be given to the question as to the kind of theory of knowledge which is possible when one does not presuppose an already elaborated metaphysics. Furthermore, from the answer that wil be given to this question will follow the answer that will be given to the question as to the possibility itself of metaphysics and, if metaphysics is indeed considered to be possible, also the answer that will be given to the question as to what kind of metaphysics is possible.

Therefore, speaking very generally at least, it is possible to characterize the two principal epistemological perspectives of modern philosophy, rationalism and empiricism, in terms of their underlying conception of man - in terms of their implicit response to the great problem of the status of man with respect to the mechanistic universe.

(1) *Rationalism.* The rationalist perspective affirms that man essentially transcends, is "outside", the mechanistic universe. Accordingly, man is not at all subject to the deterministic laws of mechanistic causality insofar as man is essentially a spiritual or immaterial entity. Man is not in any way determined by the laws of nature but is endowed with the freedom proper to an autonomous moral agent and is only subordinated to the final causality exercised by the moral law. Therefore, for the rationalist, the study of man is essentially the study of a mind, of a spirit or reason. Given this conviction, the subsequent conception as to the kind of theory of knowledge which is possible, when an already elaborated metaphysics is not presupposed, will be that of a speculative epistemology grounded within the reflexive turn of the knowing subject upon itself and its *a priori* contents.

(2) *Empiricism.* The empiricist perspective, on the other hand, affirms that man is essentially a part of, is "inside", the mechanistic universe. As far as one can know by means of exclusively natural knowledge man is simply another body in motion, an aggregate of corpuscules, within the total system of bodies in motion which is the mechanistic universe. Man is just one more material constituent of the mechanistic universe and as such is entirely subordinated to the deterministic laws of mechanistic causality. By the light of natural reason alone it is simply not possible to affirm that man is endowed with a spiritual element or that human freedom is anything more than an illusion. Therefore, for the empiricist, the study of man will simply be a particular case of the study of corpuscular nature. Given this conviciton, the subsequent conception as to the kind of theory of knowledge which is possible, when an already elaborated metaphysics is not presupposed, will be that of roughly experimental psychology - an investigation of the elementary constituents of consciousness and the process of human knowledge more or less analogous to the physicist's corpuscular analysis of matter.

In terms of these two radically different attitudes with respect to man's place in the mechanistic universe, and the different conceptions as to the kind of theory of knowledge which is accordingly deemed to be possible, one can readily grasp two points: (1) The epistemological theses which are characteristic of rationalism and empiricism respectively. (2) The consequent rationalist and empiricist attitudes with respect to the possibility and nature of metaphysics. Let us now consider both rationalism and empiricism from the point of view of both of these two points and do so in the form of the presentation of summary delineations.

(1.1) *Rationalism: Characteristic Epistemological Theses.*

(i) Theory of knowledge conceived as a speculative epistemology grounded within the reflexive turn of the subject upon itself and its *a priori* contents.

(ii) Rejection of the Aristotelian theory of abstraction.

(iii) Affirmation that not all knowledge about reality is derived from sense perception. In addition to sense perception there is another source of knowledge about reality. Namely, that *a priori* source of knowledge about reality which are the contents of the mind itself - innate ideas such as those of God, of being, of substance, of infinity.

(iv) These *a priori* ideas are not recognized as being true on the basis of some comparison with extra-mental realities therefore rejection of any correspondence theory of truth. The truth of these *a priori* ideas is ultimately guaranteed by the divine veracity and their criterion of truth is clarity and distinction.

(v) On the basis of the mind's grasp of these *a priori* ideas (if we may employ Kantian terminology), synthetic *a priori* judgments, for example the principle of sufficient reason, are possible (that is, they are verifiable).

(1.2) *Rationalism: Consequent Attitude to Metaphysics.*

(i) Metaphysics is possible.

(ii) Metaphysics has the character of an entirely *a priori,* axiomatic-deductive science patterned on the structure of Euclid's *Elements.* The entire content of metaphysics is deduced from the fundamental *a priori* ideas and the synthetic *a priori* principles that they ground.

(iii) Metaphysics as *general metaphysics* has as its fundamental operative concept that of *substance* which is expressive of the mind's grasp of reality in itself, of being as being.

(iv) Metaphysics as *special metaphysics* has as its fundamental operative concept the principle of sufficient reason by means of the application of which the mind is enabled to transcend sense experience and both affirm the existence and clarify the natures of supersensible substances.

(v) Affirmation of the validity of the ontological argument (*a priori* - from the content of the concept of God) for the existence of God.

(2.1) *Empiricism: Characteristic Epistemological Theses.*

(i) Theory of knowledge conceived as an experimental (introspective) psychology concerned with the analysis of consciousness into its elementary constituents in a manner analogous to the corpuscular analysis of matter.

(ii) Rejection of the Aristotelian doctrine of abstraction.

(iii) Affirmation that all knowledge about reality (not *all* knowledge) is derived from sense perception. This does *not* involve the denial of *a priori* knowledge. There is indeed *a priori* knowledge, as in the case of mathematics, but it is purely analytic or tautological. It involves the denial of any *a priori* knowledge about reality.

(iv) Consequently, synthetic *a priori* judgments, for example the principle of sufficient reason or of causality, are impossible. That is, it is not possible to conclusively verify such principles because of their universality and necessity. In the first place they cannot be verified as synthetic *a posteriori* judgments are verified because sense perception, as a matter of principle, yields knowledge only of the particular and the contingent. In the second place they cannot be verified as analytic *a priori* judgments are verified, on the basis of a mere analysis of the contents of their meanings, because of their claim to be informative about reality.

(2.2) *Empiricism: Consequent Attitude to Metaphysics.*

(i) Metaphysics is impossible.

(ii) Metaphysics as *general metaphysics* is impossible because the concept of substance does not express any kind of grasp of reality in itself. It is simply a label, or at the very most no more than a general idea, formed on the basis of the operation of the psychological mechanism of the association of ideas which connects particular ideas received from sensation into bundles.

(iii) Metaphysics as *special metaphysics* is impossible because, insofar as all synthetic *a priori* principles, such as the principle of sufficient reason, are, as a matter of principle, never conclusively verifiable, the mind simply cannot employ them to construct *valid* arguments whereby it could transcend experience and affirm the existence and clarify the natures of supersensible substances.

At this point a cautionary remark might well be in order. The last two decades have witnessed an increasingly widespread tendency on

the part of historians of the philosophical movement of the seventeenth century to reject and radically revise, or at least to minimalize, the standard text-book interpretation of the debate constitutive of this movement in terms of an opposition between two supposedly antagonistic schools known as "rationalism" and "empiricism" respectively.[10] It has been increasingly stressed that this once unquestioned interpretation has tended to fail to do justice to the characteristic positions of the leading philosophers of the seventeenth century by forcing them into an artificial classification - a classification which has tended both to do violence to the originality and peculiarities of these philosophers and to obscure the doctrines which are common to various philosophers when these conflicts with their hallowed categorizations as members of one or the other of the two schools postulated by the traditional interpretation.

It has been pointed out especially that the traditional interpretation must be recognized as being largely anachronistic insofar as it considers the leading philosophers of the seventeenth century in narrowly epistemological terms and does so because, being largely Kantian in inspiration, it was useful to Kant's own project to present such an interpretation of his predecessors.

Now, I would suggest that this recent criticism of the traditional interpretation of the history of modern philosophy is indeed justified. The traditional interpretation must be recognized as being anachronistic because the leading philosophers of the seventeenth century simply did not consider themselves as belonging to two distinct schools on the exclusive basis of narrowly epistemological considerations. Indeed, one might well argue that narrowly epistemological issues were not even at the centre of the debate constitutive of the philosophical movement of the seventeenth century. Accordingly, the reader should notice that in the preceding exposition I did not refer to rationalism and empiricism as two philosophical schools but rather as no more than two epistemological perspectives or, at the most, as two epistemological currents.

Nevertheless, I would suggest that the leading philosophers of the seventeenth century, at the very least by the end of the century, did think of themselves as members of different philosophical schools - indeed as members of different philosophical schools which bore the names of the two philosophers who have been singled out as the originators of modern philosophy, Descartes and Gassendi. But membership

[10] See, for example, LOEB, L. E., *From Descartes to Hume: Continental Metaphysics and the Development of Modern Philosophy*, Ithaca, NY: Cornell U.P., 1981.

of these two schools was not conceived in narrow epistemological terms but rather in terms of a number of metaphysical and ethical issues which had emerged as the result of the impact of the new quantitative physics and especially of its implications as to the status of man with respect to the newly developed mechanistic conception of the universe. On this point, and in conclusion, it might be best to leave the last word to G. W. Leibniz who, in the *New Essays,* places the following words in the mouth of Philaletes (who represents the position of Locke):

> "You sided with Descartes and with the opinion of the famous author of the *Search after Truth;* and I found the views of Gassendi, as expounded by M. Bernier, more plausible and natural. I now feel that I am put in a much stronger position by the fine work which a distinguished Englishman . . . has since published . . . under the modest title *Essay Concerning Human Understanding*... This author is very much in agreement with M. Gassendi's system, which is fundamentally that of Democritus: he supports vacuum and atoms, he believes that matter could think, that there are no innate ideas, that our mind is a *tabula rasa,* and that we do not think all the time; and he seems inclined to agree with most of M. Gassendi's objections against M. Descartes. He has enriched and strengthened this system with hundreds of fine thoughts; and I am sure that our side will now overwhelm their opponents, the Peripatetics and the Cartesians."[11]

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[11]G. W. LEIBNIZ, *New Essays on Human Understanding,* (Tran. and ed. by REMNANT, P. and BENNET, J.), Cambridge: C.U.P., 1981, p. 70.