Plato and Contemporary Natural Science*

RICHARD COLE
University of Kansas

It is commonplace to contrast modern natural science with Platonic philosophy—I intend to sketch how one may understand theoretical contemporary science as consistent with, and illuminated by, Plato. To accomplish this reconciliation, it is necessary to argue both that the use of reason in natural science and its subject matter—Nature—are platonically interpretable. Both tasks must be done without violence either to Plato or to science, although I reserve the right to differ with those who interpret the one or the other.

A commentator on Plato has an advantage; because Plato is dialectical one can amend the text without necessarily doing violence to the thought. I propose to update the divided line. Preserving the division placing the *a priori* over the *a posteriori* and limiting *a posteriori* inquiry to natural science, I shall further subdivide both the *a priori* and the *a posteriori* into noble and common sorts. Noble *a priori* inquiry I shall call "ontology," noble natural science I shall call "cosmology," common *a priori* inquiry I shall call "formal science," and common natural science I shall call "the special sciences." I shall construe the special sciences as applied formal sciences, and cosmology as applied ontology. Finally, I shall use my divided line analysis to illuminate the relation between cosmology and the special sciences.

Plato's essential insight is that there is a clear difference between knowledge and true opinion, that opinion is inferior, and that each has its own subject matter. This is not to say knowledge is unrelated to opinion, or that their objects are unrelated; quite the contrary. The object of knowledge stands to the object of opinion as reality to appearance, and knowledge is the source of the rational element in opinion. In modern language the Platonic distinction is the distinction between pure and applied inquiry.

The signpost of inferiority which natural science displays is one of modality. A scientific description, neither false nor problematic, is true,

* This paper was read to a meeting of the Metaphysical Society of America, meeting at Boston University, March, 1975. Research for this paper was supported by a grant from the General Research Fund, University of Kansas.

but unlike an *a priori* truth, not true of necessity. So we can grasp that the earth, moon, and sun are oriented as Newton described them, but see no necessity in it. Contingency is inevitable, too, for the easiest, and therefore most confident, scientific explanation. Although we are confident that a lunar eclipse was caused by the earth's shadow, and we are not wrong, still it could have been otherwise. Contingency is inescapable even for the best conceivable scientific understanding. Suppose one grasped the fundamental laws of the universe, further questions could still be asked; e.g., why these natural laws and not others? The ideal of maximum success in scientific inquiry is the idea of a terminus which falls necessarily short. There is in the noblest natural science an apprehension of bare, blunt mystery and resistance to reason.

A *priori* descriptions, i.e., definitions, are necessarily true, not because they reflect what we choose to mean by words, but for a deeper reason. A "euclidean three space" is described as a certain sort of space, but the necessity in the idea is not a consequence of a convention but of the knowledge that it is well-defined. If we have an idea that suits the requirement of well-definition, then, in an unexceptionable sense, there is such an idea, at least *in intellectu* as they used to say. Theorems provable of euclidean three-spaces are also necessary, for they inherit their necessity from the necessity of their premises and correct inference.

A *priori* inquiry in mathematics is of two sorts, the one deductive, the other dialectical. If we begin with the setting down of postulates and definitions—Plato calls them hypotheses—we can inquire into the consequences of what we have set down. If, on the other hand, we find ourselves calling two sorts of numbers by the same name without possessing a clear idea of number, we seek an idea which will accommodate both. Mathematical generalization is dialectical in that it proceeds toward a prior notion by means of hypothesis and its critique.

Platonic inquiry into fundamental being, what I call "ontology," is purely dialectical; therefore, unless completed it does not yield an idea which is seen as necessary in the way a mathematical idea is. Ontology sets down that its object, yet unacquired, have this character. Success in apprehending it is marked by a total satisfaction of intellectual curiosity, for it is conceived as the fundamental cause of everything. An inquirer does not possess such total satisfaction—he just has a vision of the ideal of it.

Plato divides *a priori* inquiry somewhat differently than I would have him do, for he assimilates the dialectical inquiry which mathematical inquiry spawns with dialectical inquiry self-consciously directed toward fundamental being. Both dialectics may have the same object, but the mathematical dialectician does not deliberately intend it. In the *Republic*, Plato characterizes mathematical inquiry as sub-dialectical in that it begins with postulates and definitions—Plato calls them hypotheses, or settings down—and proceeds deductively therefrom. Dialectical inquiry can be a source of such hypotheses, but mathematics remains a leg-work deductive science. However, if one works out a certain hint in Plato's characterization of sub-dialectical *a priori* science, one finds good reason for a different demarcation.

Plato does not restrict sub-dialectical *a priori* sciences to arithmetic and geometry; he includes therein sciences he calls *kindred* to mathematics. But the only kin he mentions are harmonics and pure astronomy. Suppose we take *all* sciences with postulational starting points and deductive methods to be kindred to mathematics; then modern mathematics, which has enlarged its subject matter beyond the traditional study of continuous and discrete quantity, qualifies. We must also include modern meta-logic, which sets down its objects—formal systems—and derives properties thereof. Nor ought we to exclude any clearly defined scientific speculation, considered apart from verification, for they can be defined and consequences drawn. The class of studies that includes mathematics and its kin can include no less than all formal sciences, and insofar as an idea is well-defined there can be a formal science which deals with it. So we develop the notion of an indefinite class of studies, all kin to mathematics, each of which is both *a priori* and postulational.

Besides its postulational starting points and deductive method, Plato represented mathematics as tied to the use of diagram and imagination. A mathematician was to the dialectician what the lover of shadows and reflections was to the natural scientist. But mathematicians and other formal scientists only occasionally depend upon imagination; we see that the most distinct division above the divided lines separates ontology from that which is directed toward the deductive unraveling of any formal object, i.e., all formal sciences.

Taking as one's task the characterization of the whole of physical nature with a view to illuminate each part and event is significantly different from the workaday study of this sort of thing or that. The study, for example, of living things, while gratifyingly general, is not cosmological. The same is true even of present-day empirical cosmology, what Hoyle calls "imperfect cosmology," for it concerns not the universe as a whole but only the gross morphology and history of as much of it as can be reached with detectable radiation.

The workaday scientist, even the empirical cosmologist, is interested in this or that sort of thing: living things, human societies, universe-parts, and the like. But each such genus, considered apart from instantiation, is, in Plato's sense, a form. If all such well-defined forms can be postulational starting points of pure sciences, then workaday *a posteriori* science depends upon workaday *a priori* science, selecting from the latter such universals as are discovered instantiated in Nature. In the *Timaeus* Plato has his dimiurge select from the forms and instantiate them in Nature.

Whenever instantiated universals are discovered, the fact of their instantiation is independent of the problem of their source, *viz.*, are they obtained by a process of abstraction from instances or in some other way? Sometimes a scientist, in seeking to explain a fact, learns a universal for the first time from the fact he seeks to explain and like facts. Sometimes it is the other way around; he has the characterization before he encounters the fact it explains. So the outlines of atomic theory were developed before Dalton made use of it, and the idea of the universe as a single entity was around before Newton or Einstein made use of it. If we suppose that people could always attend to their *a priori* business before dealing with *a posteriori* application, the business of seeking explanation would come to matching an appropriate prepackaged universal, obtained by formal studies, to appropriate facts. Therefore, if a cosmologist were to draw on the ideal of a complete understanding of fundamental Being to define a goal of maximum rationality for natural science, and draw on formal sciences for materials from which to construct his cosmology, he would construct a single, characterizable universe, viewed through all space and time as a single entity, from whose characterization might follow all explicable facts. He would, in short, do what Plato has Timaeus do, or what Newton, as a cosmologist, did, or what Einstein did in general relativity theory.

The object of ontology is fundamental Being, but human reason cannot fully and clearly know that object. It is rather seen as an ideal end of dialectical inquiry, a single, comprehensive, fundamental ground of everything. However advanced a dialectical inquiry, it stands as a transcendental cause of that inquiry's results. The cosmologist borrows that transcendent vision and embodies it in his vision of nature. However, he is doubly restricted, for besides not actually possessing fundamental knowledge of Being, he has taken a contingent subject matter which in principle cannot meet the standard of complete rational satisfaction. His task, then, is to maximize the rationality of Nature, while describing her as possessing an irremediable limitation. His subject matter is preliminarily defined; it is to construe Nature as the most comprehensible contingent being.

Science then is doubly indebted to Reason; it takes from her a stock of universals to be put to use in workaday science and an ideal of best possible Being to be the model of Nature as a whole. We must consider now what use science makes of these materials.

We first consider what it is to understand a fact as the special scientist does. A fact is understood when it is explained. There is a difference in depth of explanation; we can explain *this* eclipse of the moon by characterizing the sun-moon-earth system without mention of the cause of motion of these bodies. If we incorporate dynamics in our explanation, we recharacterize the three-body system so that we understand, for example, that each body attracts the others inversely as the square of their separation. Both the low level and the deeper explanation, if they are true, satisfy two conditions: first, that our earth, moon, and sun, are as they are described, and, second, that the description entails the singular fact of *this* eclipse. Such descriptions, however deep, describe only parts of the physical universe.

If a fact illuminated by explanation is social or psychological, the case is the same. We characterize kinds of societies or men, and scientifically understood facts follow when such characterizations are instantiated. For each understood fact there is an understanding of the characteristics of a part of Nature, and for all facts so understood there corresponds an understanding of immanent natural characteristics pock-marking the physical universe with understood parts of it. So long as we proceed in this fashion, Nature as a whole is a mysterious backdrop with bits and pieces of it known. Singular facts, shotgun-patterned through space and time, are explained by universe-parts similarly patterned.

Deep recharacterizations of universe-parts result in a reduction of the quantity of such parts and in the explanation of more facts, increasing the number of singulars understood and decreasing the number of complex universals with which they are understood. When a fact is understood, since a reason is given by its explanation, the explained fact is seen as rational. To see singular facts as thus rational is to see some rationality in Nature; to deepen explanation of them is to render rational larger portions of the mysterious backdrop of the whole of Nature. It is clear that we maximize rationality in Nature if we construe her so that all facts always and everywhere depend on a single cosmological object.

True opinion for the special sciences, however deeply it may penetrate, is an identification of a universal instantiated in a universe-part. It is true because there is that universe-part; it is opinion because that universe-part is contingent, both in that it is dependent on the whole and in that its description does not entail its existence. Workaday science borrows from formal science both the characters of universe-parts and theorems deduced from such characters, from among these theorems, when applied, are descriptions of facts. Its *a posteriori* contribution consists in the identification of these characters as instantiated.

True opinion for cosmology must have a different standard, for though the cosmologist takes Nature as the cause of all her parts he cannot provide a deduction from Nature's nature to them. In the way that fundamental Being stands to the forms, in that way must Nature stand to her parts. The cosmologist, though he cannot deduce the parts of Nature, selects features for her which are ubiquitous in her parts. In seeking materials for her characterization, then, he draws on universals which are ubiquitous; these include forms of quantity as well as others. There is then a condition of ubiquity that must be satisfied for cosmological truth. Each part of the physical universe must be definable as a kind made up of these ubiquitous characteristics, and cosmology serve as a source of predicates for each such definition. So Newton provides materials from which can be defined the earth-moon-sun system.

The cosmologist, then, renders in outline a whole which resembles, through a glass darkly, a single rationally characterizable object, from whose character we do not derive its parts but promise ourselves—in honor of the dignity of reason—that there exists such a derivation. This image of the universe as a single rational entity is an image nevertheless of a deficient thing; it is rather like a flawed divinity.