

**HOLISM AND REALISM:
A LOOK AT MARITAIN'S DISTINCTION BETWEEN SCIENCE AND
THE PHILOSOPHY OF NATURE**

JENNIFER ROSATO

Robust scientific realism about the correspondence between the individual terms and hypotheses of scientific theories and objects in the world has been out of vogue since the logical positivists failed in their efforts to reduce theory to a system of directly observable entities and immediately verifiable empirical claims. Instead, “holistic” underdetermination theses, according to which scientific hypotheses face the tribunal of experience not individually but as whole bodies of theory, have grown in popularity, replacing the positivists’ “atomistic” assumption that scientific hypotheses can be individually verified by experiment. Following Quine, this holism has often been accompanied by the antirealist thesis that the truth or falsity of scientific theory does not depend on the assumption of any extratheoretical relationship between theory and world. Thus a general epistemic pessimism about the divorce between objects in the world and the way we know them theoretically can seem to be the natural corollary of the more specific claim that the success of a scientific theory does not depend on the ability of its individual terms and hypotheses to refer to physical objects or abstract essences.

At first glance, it may seem that this philosophical trend directly conflicts with the broadly Aristotelian or Thomistic claim that the true object of scientific knowledge is sensible nature—or, as Jacques Maritain puts it in *Science and Wisdom*, “the being of things we touch and see.”¹ Indeed, Maritain’s insistence that the physical world is itself intelligible and that the scientist grasps it by means of abstraction does stand at odds with a robust antirealist thesis according to which the terms and predictions of scientific theories need not correspond to real objects. In light of this rejection of antirealism, one might be tempted to read Maritain as a naïve scientific realist for whom theoretical terms

¹ Jacques Maritain, *Science and Wisdom*, translated by Bernard Wall (New York: Charles Scribner’s Sons, 1940), 37.

and hypotheses have univocal empirical referents—in short, as a logical positivist. To do this, however, would be to make a serious mistake. While it may seem tempting to assume that broad antirealism necessarily goes hand-in-hand with the holist’s pessimism about the ability of scientific theory to describe the sensible world in neat, atomistic fashion, Maritain’s philosophy of science and epistemology reveal that it is possible both to accept the holist’s critique of scientific theory and to remain optimistic about the intelligibility of the natural world. Here I will focus on the second and fourth chapters of *The Degrees of Knowledge* in order to show that Maritain’s distinction between the physical sciences and the philosophy of nature allows him to be both a holist about scientific theory and a realist about our knowledge of sensible nature.

I. DEGREES OF ABSTRACTION AND DIFFERING CONCEPTUAL LEXICONS

One can begin to demonstrate this thesis by noting that Maritain follows Aristotle and Aquinas in asserting that all our concepts, and therefore all our knowledge, begin in the senses and are resolved in being, the first object of our intellectual apprehension.² In *The Degrees of Knowledge*, Maritain reminds us of the threefold division of knowledge, according to the three general manners in which concepts are defined: “The concepts of METAPHYSICS are resolved in being as such, *ens ut sic*; those of MATHEMATICS are resolved in that sort of being (isolated from the real) which ideal quantity is; those of PHYSICS in mobile or sensible being, *ens sensible*.”³ This division is the result of a difference in the degrees of abstraction that yield the varied concepts of physics, mathematics, and metaphysics. Physics abstracts from the “contingent and strictly individual peculiarities” of objects; to put it as Aristotle would have, physics neglects matter insofar as matter functions as a principle of individuation.⁴ However, while human knowers can overlook particularizing matter in order to formulate scientific theory, the objects of physics cannot actually exist or be conceived without it.⁵

² Jacques Maritain, *Distinguish to Unite or The Degrees of Knowledge*, translated from the 4th French edition under the supervision of Gerald B. Phelan (Notre Dame, Indiana: University of Notre Dame Press, 1995), 41.

³ *Ibid.*

⁴ *Ibid.*, 38.

⁵ *Ibid.*

The objects of mathematics, by contrast, consider only one category of property that belongs to objects—i.e., their quantity—which “is an object of thought which cannot *exist* without sensible matter, but which can be conceived without it.”⁶ Lastly, metaphysical concepts are derived when the mind considers objects abstracted from matter altogether; thus the objects of metaphysics can both exist and be conceived without matter.

In order to understand how Maritain’s holism is drawn from this account of abstraction, I will need to note one further detail: namely, that the first degree of abstraction, physics, is actually divided into a spectrum of classes of science. This division allows Maritain to provide his own gloss of the difference between inductive and deductive science, as well as to support a distinction between the “empirical” lexicon of the experimental sciences and the “ontological” lexicon of the philosophy of nature. At one end of the spectrum that constitutes physics are what Maritain refers to as properly inductive “sciences of observation,” or properly inductive sciences that yield certain empirical laws but which are unable to support claims about necessary connections between physical objects.⁷ According to Maritain, inductively established laws fail to pick out necessary connections, and thus “fall short of explanation properly so called.”⁸ Note that Maritain classically identifies proper explanation with explanation that accounts for the necessity of causal links, which in turn requires reference to the non-contingent essences of objects. Inductively established laws fail because they are the furthest removed from the essences of their objects.⁹ While inductively established laws do, as a result of abstraction, obscurely reference the essences of objects, they fail to explain because they fail to uncover “intelligible necessities.”¹⁰ Deductive sciences, by contrast, are those that yield theories that make known the necessary connections between objects. Thus, these deal more directly with the essences of objects, “not known

⁶ Ibid.

⁷ Ibid., 36.

⁸ Ibid.

⁹ Ibid.

¹⁰ Ibid.

in any exhaustive fashion ... but nevertheless known or revealed (by their externals)” and are more properly “sciences of explanation.”¹¹

The fact that there are various sorts of inductive and deductive scientific theory means that the first degree of abstraction (i.e., physics) is actually divided into a range of sorts of abstraction, each of which accesses the essences of physical objects to a different extent. Note that also included within this first degree of abstraction is a degree of knowledge that is not empirical science at all: the philosophy of nature. Located at the end of the spectrum most distant from inductive knowledge, this *philosophical* knowledge genuinely accesses intelligible essences in themselves.

Maritain relies on this metaphysical account of the abstraction that grounds empirical science in order to support the realist claim that science provides genuine causal explanations. Importantly, he notes that this puts him at odds with leading French philosophers of science like Pierre Duhem, who, notes Maritain, “thought that a physical theory is not an explanation,” but rather “a system of mathematical propositions, which have, for their purpose, to represent, as completely and simply as possible, a whole complexus of experimental laws.”¹² By maintaining that experimental science can yield causal explanations, Maritain distinguishes between experimental science and mathematics more strongly than Duhem. At the same time, however, Maritain *affirms* Duhem’s view that an important part of creating physical theory consists in “the mathematical transposition of phenomena.”¹³ More importantly, he also accepts Duhem’s claim that particular “transpositions,” or physical theories, are underdetermined by empirical data.¹⁴

¹¹ Ibid.

¹² Ibid., 47 (Maritain is here quoting Émile Picard in *Un coup d’oeil sur l’histoire des sciences et des théories physiques* [Paris: Gauthier-Villars, 1929]. He made this point in a lecture to the Académie des Sciences, on December 16, 1929).

¹³ Ibid., 48.

¹⁴ In what follows, I will be concerned with elucidating Maritain’s holism. A more thorough treatment of Maritain’s account of science, however, would stress the importance of his assertion that a large segment of science, and contemporary physics in particular, is actually a mathematization of empirical data. Indeed, Maritain posits that these branches of science constitute a “physico-mathematical” degree of knowledge that exhibits

A well-known holist about scientific theory, Duhem claimed that no particular scientific hypothesis can be tested by an experiment, since experiments test only whole bodies of theory, or sets of hypotheses, at a time. Explicitly rejecting the idea that science is a set of models that yield predictions by reflecting nature, Duhem proposed that scientific theories are networks of theoretical facts that can be more or less coherent but which are not composed of individual generalizations or descriptions of phenomena.¹⁵ Even statements that appear to be primary observational reports, claimed Duhem, are inextricably connected to a whole body of theoretical assumptions, so it is impossible to link individual hypotheses with particular observations or particular terms with determinate objects. Therefore, according to Duhem, there is no necessary correspondence between theoretical terms and particular concrete or abstract objects; theory does not produce an image of phenomena, but rather transcribes a scientist's already theory-laden interpretation of phenomena in a mathematical language.¹⁶ As we will see, these theses do not conflict with Maritain's account of knowledge by abstraction; to the contrary, on his account, holism and underdetermination are consequences of the manner of abstraction proper to the sciences.

In order to show this, I will need to return briefly to the various sorts of knowledge that are included within Maritain's first degree of abstraction, physics. Earlier, I mentioned that not only inductive and deductive science are included in this degree of abstraction, but also the philosophy of nature. While Maritain introduces the distinction between the empirical sciences and the philosophy of nature in chapter two of *The Degrees of Knowledge*, where he first discusses the three degrees of abstraction, it is not until chapter four that he draws out the full implications of the dissimilarity between philosophy and science. For Maritain, the knowledge in which consists the philosophy of nature is a knowledge of the intelligible essences of sensible things per se. The

characteristics of both the first and second degrees of abstraction (i.e., physics and mathematics). Cf. *Degrees of Knowledge*, 44-49, 64-69.

¹⁵ Anastasios Brenner, *Duhem: Science, réalité et apparence* (Paris: Librairie Philosophique J. Vrin, 1990), 123-25; Gary Gutting, *French Philosophy in the Twentieth Century* (Cambridge, Massachusetts: Cambridge University Press, 2001), 34.

¹⁶ Anastasios Brenner, *Les origines françaises de la philosophie des sciences* (Paris: Presses Universitaires de France, 2003), 53.

inductive and deductive sciences, by contrast, constitute a degree of knowledge of sensible things that is achieved by accessing the essences of objects, but which does not reveal the essences themselves. In chapter four, Maritain argues that this difference results in a distinction between the “conceptual lexicons” utilized by the philosopher and the scientist—i.e., respectively, the “*ontological*” and the “*empirical* or spatio-temporal” lexicons.¹⁷ To say that philosophy and science have differing conceptual lexicons is to say that they define their concepts differently, which in turn means that there is a difference between the types of explanation yielded by accounts that use these different concepts. The philosopher’s ontological lexicon is used to engage in “the search for [the] intimate nature and intelligible reasons” of phenomena, while the scientist’s empirical lexicon represents empirical data and provides explanation that “has no ontological value.”¹⁸

While Maritain retains his earlier assertion that the scientist “works on ... the natures or essences of the corporeal world,” he now emphasizes that these essences are nevertheless *not* the proper object of science.¹⁹ On the contrary, scientific theory prescind from philosophical questions of ontology and provides definitions simply by reference to the qualities that are observed at the most basic level of abstraction:

What things are in themselves does not interest [the physicist]. What is important are the possibilities of empirical observation and measurement which those things represent, as well as the possibility of linking together according to stable laws the data furnished by these observations and measurement. Every definition should be given, not now “by means of the proximate genus and specific difference,” but by well-determined observable and measurable properties, with the means of rediscovery and practical verification being stated in each case.²⁰

¹⁷ Maritain, *The Degrees of Knowledge*, 157.

¹⁸ *Ibid.*, 158.

¹⁹ *Ibid.*

²⁰ *Ibid.*, 159.

Thus, Maritain claims that meaning and reference in science simply do not depend on assuming that theoretical posits have anything other than theoretical being, nor does the physicist need to think he is actually referring to objects that are extramentally specified according to some objective genera and species. The abstraction proper to science is limited precisely by the inability of the scientist to make philosophical essences the referents of his theory.

II. HOLISM AND REALISM IN SCIENCE AND THE PHILOSOPHY OF NATURE

I am now finally in a position to explain Maritain's explicit endorsement of scientific holism, which follows readily from this empiricist turn. For Maritain, asserting that the type of abstraction proper to the sciences yields a system of theoretical objects whose definitions reference only "the possibility of observation and measurement" means affirming that scientific theories describe the world in the holistic way that Duhem described. That is, since scientific theory does not pick out essences, the systematization of empirical phenomena in which theory consists cannot possibly be determined by those essences. In *The Degrees of Knowledge*, Maritain follows the nineteenth century philosopher Augustin Cournot in presenting the holist thesis by means of an argument against scientific atomism.²¹ The key claim here is that it is only by thinking of the scientist as grasping the essence of things that one can ground an atomist picture according to which the "network of phenomena and relations selected by [the scientist] as an object of observation" can be expected to mirror directly the world's genuine intelligible structure.²² Although the philosopher may assert that the scientist's network is distantly supported by a network of essences, the fact that scientific theory itself does not grasp these essences means that, "more often than not, it still remains doubtful whether the more-or-less provisory and unstable categories that those sciences construct, and on which their rational task operates, correspond to those essences."²³ In short, the world itself may be determined, but it nevertheless fails to determine theory, the concepts of which remain "provisory" and "unstable." Holistic

²¹ Ibid., 27.

²² Ibid.

²³ Ibid.

underdetermination stands as a conclusion of Maritain's Thomist epistemology of science.

It is important to notice that Maritain's empiricist limitation of the abstraction proper to the experimental scientist restricts him to a narrow sort of realism regarding the physical sciences themselves. Whatever Maritain may claim about intelligible essences and the objects known by the philosopher, his account of *scientific* hypotheses is one on which reference is strictly confined according to definitions that may be given on the basis of measurable physical data. Thus, Maritain states that the "sort of realism" that can be legitimately claimed by the physicist is nothing but "the resolution of the primordial concepts of the science into complexes of elements exclusively determined by physical measurements really or imaginatively feasible"; this account "succeed[s] in shattering" the idea that the aim of science is to penetrate absolute essences.²⁴ Questions of truth for Maritain's physicist are questions about objects that only exist as part of a coherent theoretical structure—i.e., whose mode of existence is theoretical existence. In the case of the physico-mathematical sciences,²⁵ theories

will be called "true" when a coherent and fullest possible system of mathematical symbols and the explanatory entities it organizes coincides ... with measurements we have made upon the real; but it is in no wise necessary that any physical reality, any particular nature, or any ontological law in the world of bodies, correspond determinately to each of the symbols and mathematical entities in question.²⁶

Neither is the question of true explanation in physics proper a question of judgments corresponding to physical reality; rather, the

need for causal physical explanation, still immanent to the mind of the physicist, finally issues (in the highest of his syntheses) in the construction of a certain number of beings of reason based on the real and providing an image of the world (or

²⁴ *Ibid.*, 166.

²⁵ Cf. note 14 above.

²⁶ *Ibid.*, 66.

shadow of an image) apt to support his mathematical deduction.²⁷

Maritain explicitly rejects the idea that by appealing to beings of reason in place of real beings he has endorsed any sort of “pragmatism” and insists that “useful achievement” has not been “substituted for truth” in the sciences.²⁸ On the contrary, truth—i.e., “the conformity of our judgments to things”—is the same here as in all degrees of knowledge.²⁹ The sciences are unique only insofar as the “things” in question have reality only as parts of physical theories.³⁰

Nevertheless, Maritain’s account of the philosophy of nature constitutes an important addition to this highly restricted scientific realism. While Maritain claims that theoretical existence and the truth claims it supports are the only sort of existence and claims that can be considered by the physical scientist, the holism and underdetermination that accompany this philosophy of science are not features of every sort of human knowledge. Here one must remember that science for Maritain is merely one degree of knowledge among many; the physicist’s manner of abstracting from the real world is not the only way that humans abstract from the real. This leaves Maritain free to adopt a more robust realism regarding the philosopher’s ontological lexicon than he does for the scientist’s empiriological lexicon.

Thus, by means of the abstraction proper to the philosophy of nature, human knowers do acquire concepts that correspond to the real being of sensible nature—which is to say, to the intelligible essences of things. The philosophy of nature, Maritain insists, reaches the “ontological order” precisely because it consists in “an ontological

²⁷ *Ibid.*, 67.

²⁸ *Ibid.*, 65.

²⁹ *Ibid.*

³⁰ Maritain actually asserts that some of science’s theoretical terms correspond to beings of reason, while others may correspond to essences; importantly, it is a job for the philosopher rather than the scientist to figure out which is which. The point here is that the experimental sciences, like all true science, do constitute a knowledge of essences insofar as they articulate necessary truth, but this does not require that science’s theoretical entities correspond to real ontological divisions in the world nor that a working scientist assume such correspondence.

mode of analysis and conceptualization, a way of abstracting and defining which, while it has an intrinsic reference to sense perception, aims at the intelligible essence.”³¹ Note that the philosophy of nature, as part of the first order of abstraction, shares a common “universe” of knowledge with the natural sciences—namely, “the universe of the principles and laws of sensible and mobile nature, or the world of *Physica*.”³² Nevertheless, the natural sciences and the philosophy of nature differ specifically insofar as they constitute different modes of knowledge, or different conceptualizations, of the same sensible nature. In contrast to the physical sciences and as their proper fulfillment, the philosophy of nature progresses from science’s empirical observations to “another noetic plane” where knowers consider “the formalities in which the mind can discern a difference of being (corporeity, quantity, motion, life, animality, etc.) within corporeal natures taken as such.”³³

Following St. Thomas, Maritain is careful to avoid the error of asserting that in the philosophy of nature the mind directly sees the essences of material things:

[F]or the most part, the element of resistance to intelligibility introduced by matter rendering corporeal essences opaque to our view, knowable by signs rather than by properties in the ontological sense, keeps the essences hidden from us *in their specificity*.³⁴

Rather, Maritain’s claim is that in the philosophy of nature we understand the “formalities,” or the “ontological principles” of sensible being, which enable us to “grasp the essential differences of things.”³⁵ This enables us to achieve, following Aristotle,

an ontology of the sensible world... not precisely insofar as it is sensible, but insofar as it is the very world *changing being*, and

³¹ Maritain, *The Degrees of Knowledge*, 147; Maritain, *Science and Wisdom*, 61.

³² Maritain, *The Degrees of Knowledge*, 146.

³³ *Ibid.*, 189.

³⁴ *Ibid.*, 188.

³⁵ *Ibid.*, 187, 188.

that it implies in its structure intelligible invariants depending upon specifying forms.³⁶

In this way, the natural philosopher's concepts genuinely refer to the formal nature of sensible being and pick out the essential differences between beings. Thus, Maritain's holism about the theories of physical science fails to result in a broad antirealism about our knowledge of sensible nature, since the same objects that ground the physicist's beings of reason can also, when the mind engages with them in a different manner, yield the philosopher's more robustly referential concepts—concepts that correspond to nothing less than the essences that ground the physicist's theoretical concepts.

Maritain's account of science and the philosophy of nature thus serves as a paradigm theory wherein holism regarding scientific theories is not supported by antirealism regarding language or skepticism regarding knowledge, but is rather situated within a realist epistemology of abstraction grounded in turn on a metaphysics of essences. Surely this combination stands as a promising alternative for all those philosophers of science who are convinced of holism (perhaps by Duhemian concerns regarding the theory-ladenness of observation), yet who are unwilling to give up on the idea that the natural conclusion of empirical observation is theoretical knowledge of sensible nature itself.

³⁶ *Ibid.*, 187.