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# ARISTOTLE RETURNS

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*Neo-Aristotelian Perspectives on Contemporary Science*

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Raphael's *School of Athens* depicts Aristotle and Plato at the center of a group of ancient Greek philosophers modeled on Raphael's contemporaries. Plato's finger points upward, while Aristotle's hand is held at waist height, stretched out toward the ground. The image captures the major philosophical difference between the two great thinkers of antiquity: While Plato thought that real things (what he called the "forms") lie outside our experience, Aristotle believed that real things (which he called "substances") are in the everyday world around us. This is why so much of Aristotle's work covers topics which would now be the subject of empirical science (animal biology, the weather, and so on). With his commitment to the reality of the ordinary things we experience and his tireless need to classify and taxonomize, Aristotle was in some ways the first systematic scientist of the Western world.

Aristotle's view that substances are the fundamental realities was put forward in his difficult and influential work known as the *Metaphysics*. We owe the term "metaphysics" itself to Aristotle, though in a rather indirect way. When his works were collected in the edition made by Andronicus of Rhodes in the first century b.c., the writings dealing with substance and causation were placed after his theory of nature, which appeared in the book known as the *Physics* (from the Greek word for nature, *phusis*). Hence, the work was described as "what comes after the *Physics*," from which we derive our word *metaphysics*. Yet this word has something of a philosophical justification, too, for while Aristotle's *Physics* deals with questions about time and change, the *Metaphysics* goes further ("after physics," as it were) and asks about being as such. What does it mean for anything to *be*?

Aristotle approaches this question by describing the nature of the most fundamental beings, those he called "primary substances." His paradigm of a substance is an organism: an individual horse or human being. It is crucial, then, that Aristotle's word "substance" does not mean "stuff" (as in "tar is a thick, black, viscous substance"). It means, rather, a fundamental being.

Primary substances are characterized by their essences. All beings can be classified in terms of genera and species: Thus, human beings are of the genus *animal*, and the species *rational*. It is of the essence of human beings in general, then, to be rational animals. But what is it to be a primary or individual substance—say, an individual human being? Aristotle argued that

each individual substance was a kind of compound, made of matter organized in a certain way. The way in which something is organized he called its *form*. This is known as the “hylomorphic” view of substance, from the Greek *hyle* (matter) and *morphe* (form).

The form of an individual substance is the essence of the kind of substance, exemplified in an individual member of that kind. This is the crucial difference between the Aristotelian and Platonic conceptions of form. For Plato, the ordinary things we see around us are in some way imperfect versions of the real forms which lie outside experience. The forms are not in the objects themselves; if anything, the objects approximate to their forms. Individual horses approximate to, or participate in, or imperfectly resemble the “form of the horse.”

For Aristotle, by contrast, the form of a substance is in the substance itself (in traditional terminology, it is immanent, rather than transcendent). Moreover, the form explains the characteristic activity of a substance, as being in accordance with what it is ultimately *for*: The form is the principle that governs the activity of a substance, that which explains why a substance does what it does. The goal of a human being, for example, is to live a life of rational activity; something having the essence of a rational animal will strive toward this goal. Thus Aristotle’s theory of substance is sometimes called a “teleological” theory: It describes a substance in terms of its characteristic goal (*telos* in Greek).

It is a commonplace of the history of science and philosophy that this Aristotelian philosophy—which dominated the academic (or scholastic) philosophy of the Middle Ages in the monasteries and universities of Europe—was overthrown by the Scientific Revolution of the sixteenth and seventeenth centuries, a revolution embodied in the works of Galileo, Francis Bacon, and René Descartes. Scholastics had thought of everything in the world as having purposes and goals. The new philosophers of the Scientific Revolution conceived the world instead in terms of mathematically measurable mechanisms. Galileo famously spoke of “this grand book the universe, which . . . is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures, without which it is humanly impossible to understand a single word of it.” The new mathematical or “mechanical” philosophy scorned the Aristotelian philosophy of the scholastic period. Francis Bacon said that Aristotle “made his natural philosophy a mere bond-servant to his logic, thereby rendering it contentious and well nigh useless.” In other words, his philosophy of nature was *a priori* (prior to experience) and based purely on the concepts of things derived from logical classification. Despite misrepresenting Aristotle’s own dedication to empirical inquiry, this kind of criticism stuck. In the wider culture, the rejection of scholasticism was immortalized by the remark of the doctor in Molière’s play *The Hypochondriac*, that opium puts us to sleep because it has a “dormitive virtue” (*virtus dormitiva*).

This customary story of the Scientific Revolution and its rejection of Aristotelian scholasticism is incomplete and inaccurate in many ways. Not all great philosophers of the period rejected Aristotelian thinking in its entirety. Gottfried Wilhelm Leibniz (1646–1716) criticized scholastic philosophers who “believed they could explain the properties of bodies by referring to forms and qualities, without taking the trouble to find out how they worked: as if we were happy to say that a clock has a time-indicative quality deriving from its form, without considering what all that amounted to.” But despite this criticism, Leibniz said that Aristotelian substantial forms “are not so far from the truth, nor so ridiculous, as the common run of our new philosophers suppose.” Substance and form could be used to explain the ultimate nature of things, Leibniz believed, even if they are not needed to explain ordinary, everyday things, like the time-keeping properties of clocks. It is also important to remember that within the Catholic intellectual tradition, Aristotelian ideas continued to be taught in universities and seminaries for centuries after the Scientific Revolution.

Nonetheless, Aristotelian metaphysics was largely absent from what might be called (with apologies to the seminaries) mainstream philosophy from Descartes to the present day. Metaphysics took various forms between then and now, but almost none of it involved Aristotelian notions of *telos*, form, or substance. The history of philosophy in the twentieth century is instructive. In English-speaking (“analytic”) philosophy, the attitude to metaphysics—that is, to abstract, non-scientific, or non-empirical speculation about the nature of reality—was dominated by the critique of the logical positivists of the pre-World War II Vienna Circle. These philosophers proposed that verifiability by empirical science was the measure of meaningfulness for claims about the world. Metaphysical claims—including but not limited to traditional Aristotelian claims about substance, essence, form, and so on—would be examples of the unverifiable. Metaphysics was dismissed as outdated pseudoscience.

Some logical positivists traced their inspiration from the philosophy of David Hume (1711–1776), who had proposed a division of claims into those that are “matters of fact” and those that involve only “relations of ideas.” Ordinary empirical claims are in the first category, while mathematics and logic are in the second. If some inquiry—Hume famously took “divinity or school metaphysics” as an example—fits into neither category, then his advice was to “commit it then to the flames: for it can contain nothing but sophistry and illusion.” This sums up the logical positivists’ approach to metaphysics (and theology, for that matter).

Nonetheless, Hume had a metaphysics of his own—a rather austere one, but a metaphysics nonetheless. His metaphysics denied that there was any *necessity* in reality at all: Things happen as they do not because of any necessity or essence or ultimate reason, but because they just do. The world is a regular place; things happen in generally unsurprising ways; but this is not an indication of any deeper necessity in nature. Causation—what Hume called “the cement of the Universe”—is just a matter of the “constant conjunction” of things of similar kinds: Smoke always follows fire, and so on. Defenders of Hume’s metaphysics called the summaries of these regularities “laws” and interpreted scientific laws as generalizations of this kind. With the demise of logical positivism in the 1950s and ’60s, Humean theories of cause and law became the foundations of metaphysics in analytic philosophy. Indeed, if you had left the world of philosophy in the 1970s, you might have thought that Humean, empiricist, science-based metaphysics was the only metaphysics worth taking seriously.

Things did not stay like this, however. Aristotelian metaphysics started to return, and the volume under review is one of many books that have come out in recent years defending Aristotelian views of causation, substance, attribute, and even essence and form. How did this change come about? And how can Aristotelian metaphysics—which, if the standard history is to be believed, was rejected on the basis of discoveries of modern science—be part of a serious, scientific worldview? How can serious thinkers propose “neo-Aristotelian perspectives” on contemporary science? John Haldane, in the preface to *Neo-Aristotelian Perspectives*, poses the challenge by asking why this project isn’t like “astrological perspectives on astronomy.”

The first factor in the rebirth of Aristotelianism came from an unexpected place: formal logic, in particular the logical theories developed in the 1960s and ’70s by Saul Kripke, one of the great philosophers of the late twentieth century. A teenage prodigy, Kripke developed a way to understand the logic of possibility and necessity (so-called “modal logics”), which led to certain natural metaphysical interpretations. Philosophers had talked for some time in terms of necessary truth as truth in all possible worlds. Kripke introduced a precise way of formulating this idea, and pursued its interpretation into a metaphysics of essence and necessity. One central idea was that if we want to make sense when we say that something is necessarily such and such (for example, that a person is necessarily human), we should think of this as a feature that it has in all possible worlds in which it exists. But if this is the right way to think, then we must also be able to identify the same individual in these different possible worlds. And in order to do this, there must be something about it which makes it the individual it is in each of the worlds in which it exists. And what is this but its essence?

Kripke extended the idea of essence beyond individuals to kinds of things, such as gold and water. We can imagine that gold might have a slightly different color, for example, but what makes it the case that it is *gold* we are imagining, rather than something that is rather like gold in certain respects? Kripke argued that to identify gold in different possible situations requires that gold have an essence. He proposed that the essence of an element is its atomic number, so gold is essentially the element with the atomic number 79. The details do not matter here; what was important was the idea that the world has a natural order, an order which is neither imposed by our interpretation nor just the order of Humean laws of nature. Human beings discovered that water is H<sub>2</sub>O; we did not invent this fact. What we were discovering, Kripke and his followers argued, is not just a law or regularity: It is rather the essence of the natural kind water. These ideas are clearly Aristotelian in inspiration.

Essences are, of course, anathema to Humean metaphysics and to the post-positivist philosophy of W. V. Quine and his followers (Quine himself said that Aristotle’s distinction between essence and accident is “surely indefensible”). But armed with Kripke’s logical and metaphysical framework, people could defend essence against the Quinean critique. More recently, self-identified Aristotelians such as Kit Fine have argued that the natural order of the world requires that certain things are more fundamental than others, and that fundamental things stand in a relation to non-fundamental things that can be called “grounding.” For example, the United Nations genuinely exists; it is an entity, but no one would claim it is a fundamental entity. The United Nations is made up of entities, nations, which perhaps have more of a claim to be real, and these things themselves are made up of entities, human beings, which an Aristotelian would call substances. It is asserted that the less

fundamental entities can be grounded in the being and activity of more fundamental entities. (In the volume under review, Robert Koons discusses grounding in the context of an Aristotelian philosophy of physics.)

The second area of philosophy in which Aristotelian ideas has returned is the philosophy of causation (or causality): the study of cause and effect. According to Hume's influential conception of causation, "all events seem to be entirely loose and separate." There is no necessary connection between distinct existences. Yet Humeans always had trouble with causal relations that were a result of so-called "dispositional" properties: solubility, fragility, and so on. These are properties that are described in terms of the effects that their possession is "disposed" to bring about—dissolving, breaking, etc. How can all events be "loose and separate" if some events (such as dissolving) seem to be essentially or metaphysically connected to their causes (solubility)?

Humeans have responded by arguing that such dispositionality is not a real feature of the world, but only an artifact of our description of it. What causes dissolving is the interaction between certain events (being put in water, say) and the "structural" or "categorical" properties of things (molecular structure, and so on). And these interactions are covered by laws of nature, as per the usual Humean theory of causation. Defenders of dispositions push back against this: How do we actually specify these supposed "structural" properties? Isn't structure partly characterized in dispositional terms (for example, in terms of the ability to resist pressure at various points)?

This line of thought can be supported by looking closely at what the laws of nature actually say. Many laws of nature characterize the properties of things in terms of the effects that an object's having these properties lead to. For example, Newton's second law of motion defines the force exerted on a body as the product of its mass and its acceleration (force equals mass times acceleration or  $f=ma$ ). Defenders of the reality of dispositions argue that this law can be understood as a definition of what, say, an object's mass—one of its properties—*really is*: It is a disposition to accelerate under a given force, in accord with that equation. So rather than just describing a mere regularity between "loose and separate" existences, as the Humeans say, laws like Newton's should be understood as defining the nature of properties in terms of their characteristic effects—that is, in dispositional terms.

This kind of challenge to the Humean view led to the development of sophisticated theories of properties understood as "causal powers." This terminology was introduced in an influential book by Rom Harré and E. H. Madden in 1975, and the basic idea has been developed more recently in various ways by George Molnar (*Powers*, 2003), Stephen Mumford and Rani Lill Anjum (*Getting Causes from Powers*, 2011), and Anna Marmodoro (*The Metaphysics of Powers*, 2010). Marmodoro is one of the recent philosophers who have brought out most explicitly the Aristotelian roots of the powers-dispositions view of causation, linking it to Aristotle's famous discussions of potentiality and actuality. Her work is well represented in the volume under review by an essay (cowritten with Christopher Austin) linking the notion of potentiality with the concept of the unity of an organism. In an interesting and complementary discussion, Janice Chik Breidenbach's essay defends the Aristotelian view that substances themselves can be causes (it was the horse that knocked down the gate, not just some event involving, for instance, the horse's legs). And Humeanism in metaphysics as a whole is discussed in William Simpson's essay on why dispositions cannot be fully or properly accommodated within a Humean framework.

A third important factor in the revival of Aristotelian metaphysics comes from the development of the philosophy of science itself. Again, the crucial immediate historical precursors were the logical positivists and those influenced by them. The logical positivists had seen scientific theories as aiming at the statement of laws of nature which were as general and exceptionless as possible. The paradigm was physics: Laws such as Newton's aim to state the most general truths about how the universe behaves. According to the positivists, the fact that Newton's laws are not actually true should not be blamed on their claim to generality. Rather, these philosophers looked to replace these laws with laws that were equally general. This idea—science aims at laws, and laws should be regarded as statements that are as general and exceptionless as possible—came under critical scrutiny in work from the 1970s and '80s. This work emphasized the partial, local nature of scientific theory, the importance of modeling in science, and the unrealistic character of the positivists' description of science as a list of statements of universal laws. An influential figure here is Nancy Cartwright, who gave an alternative description of science in terms of the measurement of "Nature's capacities." Rather than being something of which one single scientific story could be told—in a "theory of everything," as it were—the world is, in Cartwright's image, irreducibly "dappled." It is made up of a plurality of different kinds of things, about which there is no one fundamental account, only separate accounts for separate kinds of things and their various capacities. This is clearly an Aristotelian picture, as Cartwright herself



acknowledges, with its emphasis on capacities (a notion closely related to that of a power or disposition) and on things being of different kinds. In *Neo-Aristotelian Perspectives*, Xavi Lanao and Nicholas Teh apply some of Cartwright's ideas to argue that even classical mechanics does not conform to the "fundamentalist" picture of science criticized by Cartwright.

To these factors must be added a fourth factor, which is often not explicitly credited as an influence on the present rebirth of Aristotelianism: the influence of Catholic philosophy and its own resilient metaphysics. It will not be news to readers of this journal that Catholic seminaries and universities continued to teach Thomistic philosophy (itself a form of Aristotelianism), and leading Thomist (or Thomism-inspired) philosophers such as Bernard Lonergan have had a wide influence, albeit one which rarely made contact with mainstream metaphysics in the twentieth century. Yet the revolt against the dominant Humean metaphysics in recent decades has led to more dialogue (and even collaboration) between Catholic and what I am calling mainstream philosophy. The present book is a good example. Many of the contributors are Roman Catholics—some known independently for their work in the philosophy of religion—and some teach at Catholic universities in the United States. Their Catholicism plays little direct role in their actual philosophical contributions to this volume, but it provides the intellectual framework within which many of these thinkers work.

One way in which Thomistic metaphysics influences the rest of philosophy, for example, is in the question of the soul and its relation to the body. It is easy to see why this should be such an important question for Catholics. The traditional Thomistic view, drawn from Aristotle, is hylomorphic: The soul is the form of the body's matter. For Aristotle, any substance (like a human being) is a compound of form and matter; the matter cannot exist without the form, and the form cannot exist without the matter. In the current volume, William Jaworski gives a clear interpretation of how this view of the human being might "leave it unmysterious how thought, feeling and perception can exist in the natural world." Another important area where contemporary hylomorphists apply their ideas is the philosophy of biology, exemplified here in fine essays by David Oderberg and Daniel De Haan.

I hope that these largely historical considerations begin to clarify why Aristotelian philosophy (in particular, metaphysics) has returned. But I hope they also show how Aristotelian metaphysics can be scientifically defensible. Remember that the worry was that the Scientific Revolution of the sixteenth and seventeenth centuries saw Aristotelian philosophy as unscientific—in a sense, the traditional view is that science as a systematic attempt at genuine explanation only began with the rejection of Aristotelianism and scholasticism.

But it should be noted that these are philosophical claims, not scientific ones. Like the positivists' claim that only what can be verified can be genuinely meaningful, or the "scientistic" claim that science can explain everything, these are not claims made within scientific theories themselves. Indeed, metaphysical claims—about substance, cause, change, potentiality, etc.—are very rarely settled by the content of scientific theories. If you are interested in how change is possible, you will not look to physics or chemistry. Physicists and chemists presuppose that change is possible and then go on to talk about the specific nature of specific changes. Similarly, physics and chemistry do not settle the question of whether the physical world is all there is; that question must be left to metaphysics.

Although science is not itself metaphysics, metaphysics of science is unavoidable. Once we start theorizing at a certain level of generality, we cannot escape metaphysical commitments. For example, if we ask what kind of entities physical theories are committed to, we may have to answer in terms of traditional categories such as substance, property, object, process—or specify some new categories. This does not mean that physicists must be metaphysicians, only that if they enter into metaphysical speculation, they should acknowledge that others have been there before them, and that the questions are not easy. For example, in attempting to argue that a causal connection exists between some phenomena, it is common to find scientists saying "correlation is not causation"—and they are right. But what is causation, then, and how does it differ from mere correlation? Answering this requires metaphysics. Those philosophers and scientists who dismiss metaphysics, often casually and without much argument, have to demonstrate how they can do this without doing metaphysics themselves. I predict that they will not be able to do this. Even the logical positivists had metaphysical assumptions.

The lesson of this is that seventeenth-century science did not prove that Aristotelian metaphysics failed—this was simply a claim made by philosophers. Whether science requires specific metaphysical assumptions or not is itself a metaphysical debate, which requires knowledge of science but is not settled by it. Aristotelian metaphysical categories—substance, form, capacity, essence—can be intelligibly applied to the findings of science. Or, at least, there are no scientific arguments against

this. This is why *Neo-Aristotelian Perspectives on Contemporary Science* is not analogous to neo-astrological perspectives on contemporary astronomy.

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