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The Catholic Intellectual Tradition

Scholarship, Faith, and Higher Education

Edited by John J. O’Keefe, Gina Merys, and Bridget Keegan

Response

Another Physicist Thinks It Through

Michael Cherney, Creighton University

[1] I am grateful to the organizers of the Symposium on the Catholic Intellectual Tradition who have allowed me to begin to organize a set of thoughts. I am indebted to my son, the mathematician and philosopher, for his contributions to this chapter. His insights have been particularly valuable since what I can express still remains far from something systematic. I also want to thank the participants in the symposium who gave me feedback that helped me reshape my presentation into something that could reasonably be expressed on paper.

[2] The title of this work challenges the depiction found in a chapter (*A Physicist Thinks It Through*) of a book (*Why I Am Still a Christian*) from the tradition of apologetics. In my view, apologetics is not the route taken by the majority of physicists who think there may be more

to human experience of the world than the descriptions given by science. I should add that there is diversity of views among physicists, and I will only present one of these.

[3] As a species, mankind seems naturally opposed to radical change. We hold on to what we know and the frameworks that help define it. Most of us like order, certitude, and a sort of meaning which conflicts with the more flexible mind that is desired in physics. The physicist's mind is one that is interested at arriving at the best model to describe a set of results. The physicist's current model for "truth" is based on what is consistent with the body of previous observations and what is predictive. The best models are those that fit well with the existing data and can provide hypotheses that can be replicated. Truth – knowledge of our reality – is, in turn, viewed as dynamic and fluid. New discoveries are expected to change the way we think and interact with the world. A physicist who from time to time fundamentally changes his or her mind on how data are interpreted and what is the path to follow is not considered to be a "flip-flopper" but instead this person is considered to be rational.

[4] In contrast, Catholicism views some truths as foundational. There is a God. He sent his son to save us from death. His son will return. Like the scientific community, the Catholic fold defines and envelops itself with practices that work to form a shared framework. Catholics share a foundation in scripture and a living tradition. Among physicists, there is a common shared history of recorded observations and published phenomenology. New observations and new phenomenology are expected as part of the physicist's way of proceeding. Yet, despite these foundational commitments, Catholicism is not rigid, as it may appear to some. Interpretation is occasionally challenged, rational thought is generally prized and the tradition of the faith is, in some ways, continually defined in the present. I personally find Catholicism open and even partially supportive of the change suggested by physics.

[5] Physics and Catholic philosophy grow out of a common tradition of natural philosophy. In the 15th and 16th centuries these went their separate ways with physics focusing on the question "How?" and Catholic philosophy focusing on the question "Why?" (In such a view, models that are not seen as predictive, like extra dimensions in space, fall into the realm of philosophy more than in experimental science.) We find in the Catholic Intellectual Tradition a rich and mixed history interacting with the development of physics. While many tend to see these two forces as straining each other, we should view Catholic philosophy as a way to answer those questions science does not. Science and religion attempt to address fundamentally different questions. They address complementary human desires to know.

[6] Historically, the Catholic Intellectual Tradition has fostered an environment of inquiry akin to the scientific method. Since the fall of the Roman Empire, the Church acted as a bastion for scholarly thought and transmission. Monks copied the central intellectual texts of antiquity. Monasteries also preserved the skills of literacy, writing, and arithmetic. The Medieval educational system served the needs of religious orders in training their recruits. Although the seven liberal arts grew out of a classical tradition, medieval education was characterized by the *Trivium* of rhetoric, grammar, and logic as well as the *Quadrivium* of arithmetic, geometry, astronomy, and harmonics. In turn, there should be little surprise to learn that most of Europe's great minds from the fall of the Roman Empire to the mid-1300s were members of the clergy.

[7] The Church's role as a center of education was further accentuated as it helped develop Europe's educational system. The Church with its own developed curriculum helped create the first degree granting universities. The first was in Bologna (1088), which was later followed by the University of Paris (1150), Oxford (1167), and Cambridge (1208). Because many of the rural and urban schools were associated with the local parish or monastery, the Church also often influenced primary education. Later, secondary education would also be largely influenced by the emergence of Jesuit secondary schools and universities. As a result, we find that the Church had a profound impact on European thought and development.

[8] Notable Catholic figures that helped form this early scientific period include Albertus Magnus (1206-1280), Roger Bacon (1214-1294), and William of Ockham (1280-1349). The Dominican friar and bishop, Albertus Magnus is considered the greatest theologian of his day and one of the first to apply Aristotelian thought to theology. Believing that what we call today religion and science were both embodied in what was then natural philosophy, he pushed his students not simply to accept the statements of others, but to study first-hand the causes, the "why" and the "how" suggested by observation. The Franciscan friar Roger Bacon is considered the first strong proponent of empiricism and the scientific method. He contended that experience and observation supersede argumentative proof. Another Franciscan friar, William of Ockham, had an equally large idea of how science and knowledge should be approached. William argued for simplicity in reasoning (which would later be known as the principle of Ockham's razor) as well as the importance of supplying empirical reasons for one's thought. He contended that explanations should follow a principle of parsimony or the authority of sacred scripture (with the latter almost always neglected in any contemporary rationalist's description of Ockham's razor).

[9] Although it is true that the Church helped to foster independent thought, it is also true that fear of challenges to the Church's traditional authority and role as single interpreter of the Word of God led Church officials to restrict the intellectual activity of its members. For example, the Church confronted physics when Copernicus and Galileo presented models that seemed to contradict a literal reading of certain passages of sacred scripture. Emerging scientific models went on to dispute aspects of the cosmology that had been a part of the Church's tradition for millennia. Galileo's discovery of the moons of Jupiter and sunspots only added to the forces challenging traditional cosmology. Copernicus, perhaps in spite of his clerical status, posited a heliocentric system as a simpler and more explanatory model to describe what we see in the heavens. Galileo displayed a strong will (a character trait of many physicists) and made the argument for a heliocentric system in a way that likely was considered derogatory to church officials, and the church placed the works of Copernicus, Galileo, and Kepler on the index of forbidden books. Yet, remarkably, the two understood and responded to the displeasure of the Church: Galileo recanted and Copernicus delayed publication of the main body of his work until the end of his life.

[10] Despite these challenges, Catholic scientists continued to have a major influence in the following centuries. The basic units of measurement in electricity carry the names of Catholic thinkers. Charles Agustin de Coulomb (1736-1806) was the first to express electrical force mathematically, Alessandro Volta (1745-1827) found sources of charge, and Andre Marie Ampere (1775-1836) gave a mathematical description of electricity.

[11] Contributions continued well into the twentieth century where, despite the resistance to the likes of Galileo and Copernicus, there are two examples of work that would not have come from a tradition that held a literal interpretation of scriptures. The Catholic priest Georges Lemaître (1894-1966) is credited as being one of the founders of the Big Bang theory, which currently acts as the generally accepted model for the evolution of our universe. The Jesuit priest Timothy Toohig (1928-2001) was U.S. Department of Energy program manager for American contributions to the Large Hadron Collider, which provides particle physicists with an attempt to create a “little bang.”

[12] Flexibility is required when working on the fringes of human knowledge. In a public lecture some time ago, I advanced the idea that change happens when old white men die. In the time since I made that statement, I have discovered very nearly the same comment has been uttered by Max Planck (and by Warren Buffet). Inflexibility can be as ingrained in the scientific community as in any religious community. It took nearly twenty years for Einstein to be formally recognized for his theory of relativity. I have imagined that if I had been among Einstein’s professors seeing him carry Maxwell’s description of electricity and magnetism to its absurd conclusions, I would have told him “Albert, let it go. It’s only a model.” These absurd conclusions formed the basis of relativity. We all embrace aspects of the world as we imagine it to be or as we imagine God should have made it. Even Einstein had difficulty accepting the fundamental tenets of quantum mechanics.

[13] The realm of science, though seemingly large, is itself constrained by what can be tested. Thus, when we ask questions such as, “Can science prove Christianity?” we demonstrate a level of ignorance about the nature of science. Science does not prove but provides best predictions based on what can be observed. Thus, it would be a mistake to think that scientific inquiry is ever complete or that any particular model is entirely definitive. Scientists who are aware of these limits, however, must be careful about what they say because of the way the public thinks about science. I have a British friend who was interviewed by a major newspaper about the possibility of high-energy nuclear collisions creating a black hole that would engulf the earth. He explained that earth had experienced this type of interaction through cosmic rays for billions of years. The reporter concluded by asking if my colleague could say with certainty that such a black hole would not be produced. My friend replied that although as a scientist he could never say anything with absolute certainty, he could say this work is not dangerous to the public. The newspaper ran a story saying they were unable to get a guarantee from the scientists that they would not destroy the world. “Certainty” carries different meanings for different people.

[14] Models, comprehensible descriptions – not truth or certainty – are the result of the physicist’s study. In a way, these models function like the rabbinic tradition: physicists, like rabbis, argue about interpretation. As part of the professional training those involved start to develop a sense of confidence in what they think as an individual. They share ideas with others. They often listen to the criticism and sometimes change their minds. Physics, of course, remains a human endeavor. There are well-publicized cases in which scientific collaboration breaks down and dominant personalities subjugate others. Such breakdowns may result in greater efficiency of effort at some level (more people collaborating on a single project) but they also are more likely to produce mistakes. In addition, the models in physics are not always based upon the principle of parsimony, as certain rationalists might lead one

two believe. Copernicus suggested a model that was not the best fit to the data. Einstein's theory of relativity was based on the seemingly absurd conclusions following from the premise that the models of electricity and magnetism must hold equally for all observers. Physicists are often drawn to symmetry and order as the dominant underlying principle, which can lead to surprising and unanticipated conclusions.

[15] In general, science does well when there is support for its practical accomplishments. It does even better when there is support for its potential. This is a result of many advances being serendipitous or at the very least incidental. We look at the way the lunar missions changed the world not by anything that had to do with the moon, but with the creation of mini-computer technology. As a high-energy nuclear physicist I have often been asked what my work has contributed the world. It was only one day when my wife nudged me and said "The Web" that I recalled a group of men working down the hall from me in the mid-1980s. These men were developing a way for members of large international collaborations to share their data. They created a protocol that began with "http://www." At the time I wondered why all of these men in suits were visiting the laboratory down the hall.

[16] When considering all of these things together, it seems to me that the Catholic worldview is generally consistent with doing science. Although the quest for predictability and repeatability has not always been valued, these notions have generally been integrated into the Catholic tradition for at least the last 300 years. In contrast, there are other religious traditions that favor either an unordered world or an interventionist God. Catholicism generally does not view the world as the battleground for the forces of good and evil. Indeed, recent developments in process theology offer an interesting synthesis that allow the material and spiritual aspects of a dynamic world to interact more creatively. In my view this avenue of inquiry holds much potential for the dialogue between science and religion even though many aspects of process thought are problematic both to mainstream science and to mainstream religion.

[17] Moreover, science and faith have more in common than is often perceived. The scientific method requires in a way analogous to faith a sense that there is an external world, the world that Descartes will have us infer. We cannot prove there is a reality that is external to our own consciousness. Our every day life requires that we accept its existence, and, having accepted it, we create models for dealing with it. These models are testable. We also expect the results to some extent be repeatable. We create a personal sense of what we believe. We create a communal sense of what we believe when we discuss our results with others. These discussions can be between trained specialists, but probably more important are the confirmations we share on a routine basis. Over time we build up a body of knowledge. I would contend that the descriptions we make of our world and the models that we make are a function of a time and place in history. We create models based on things we can understand. Fundamental paradigms in physics have moved from a particle description, to a fluid description, to a wave description. The predispositions we hold also influence where and how we make our observations. Science and religion are both about the business of ordering, categorizing, and interpreting reality.

[18] Coming to recognize order in the physical world and perceiving the reality of God are also analogous. Over time I have come to realize that a predisposition to seeing a particular

phenomenon often influences its observation. In high-energy physics we look for signs of particles according to their hypothesized properties. This year I was in Utah and went off the highway to look for petroglyphs that I had read could be found in the area. I looked for some marker because I felt something as interesting as this deserved at least a roadside sign. Stopping the car in the place I thought they should be, I eventually found a plaque mounted on a cliff that identified this as the correct geographic area. A couple on a motorcycle pulled up to where I was parked, and I immediately asked the man on the motorcycle where the petroglyphs could be found. He told me they were right in front of my face. At that instant I could start to see picture after picture in the cliff. I was overjoyed and wandered in a state of continuous discovery for the next 30 minutes. What we expect to see has a strong influence on what we see.

[19] I would contend that our openness to seeing impacts both scientific observation and religious experience. Thus, there can be significant amounts of commonality in the views of a tolerant scientist and a tolerant believer. Both science and religion are damaged when they become vehicles for blind acceptance whether it is in the name of faith or in the name of rationalism. Some recovery of the role of experience and perception in the acquisition of both scientific and religious knowledge would do much to help bridge the distance that often separates the two. Two great minds, Francis Bacon and Ignatius of Loyola, have given us guidelines for facilitating these experiences. Bacon provides us with a method for experiencing the physical world and Ignatius documents a method for experiencing God's grace. In the intervening 500 years both Bacon's and Ignatius' ways of experiencing have developed significantly and often seem to operate in wholly independent realities, but I would contend that both traditions are lessened when they lose the sense of experiential dynamism that once united them.