The Science before Science:
Reintegration of the Modern Mind and its Science

Anthony Rizzi, Institute for Advanced Physics

October, 2006, plenary talk at the American Maritain Conference
Published 2011 in: *Reading the Cosmos: Nature, Science and Wisdom*

Abstract: The misunderstanding of the meaning and place of the specialized sciences, in particular the base science of physics, has led to a hardened philosophical idealism that is eating away at our cultural respect for truth. The root of this problem is the lack of understanding of the starting points of all human understanding, i.e., the generic things we know through our senses. Only by rediscovering these starting points and carrying them through the entire structure of physics and eventually all the sciences--thus grounding them and clarifying their context and meaning--will we again stabilize our thinking. In order to begin this process, we first need to recognize that there is a radical split in our mindset because of that insecure base. And, the insecure base, in turn, results largely from the misunderstanding of the radically new (and good in itself) mathematical and beings-of-reason intensive approach of modern science that fueled the scientific revolution.

Introduction[1]

The idea that there is no truth has been steadily gaining ground since before the Enlightenment. Outside of the hard sciences,[2] the idea is now current that pragmatism in every sphere, from business to within family life, is the only reality; what works is what's real. Even--in many areas one can say especially--within academia, expected functionary roles threaten to replace thoughtful activity. We are, it seems, much too busy to have time to determine what it is that actually works or what the goal of making things work is. Many have forgotten the question: will it make me happy? Philosophy, the feeling continues, is an arm chair discipline that cannot really affect how one thinks and acts in the cold reality of the world; it is, at best, enjoyable mental work, a sort of mental equivalent of the Rubik's cube; namely, it's purely *academic*. You have your philosophy; I have mine. The only exception to the anti-truth fad seems to be science. Only those

[1] Many more specifics on the topic of this paper can be found in the book by a similar name: Anthony Rizzi, The Science Before Science: A Guide to Thinking in the 21st Century (IAP Press, 2004).

[2] The hard sciences are physics, chemistry, and biology and related disciplines. In the practical end of these disciplines, i.e. the technical applications of their principles, there is a parallel recognition of objectivity. For instance, a mechanical engineer will recognize that, no matter what other practical contingencies obtain, a bridge will fail if certain physical principles aren't respected. In addition, non-technical people will also tend to believe such an engineer, though sometimes, as was the case with the space shuttle *Challenger* o-ring debacle, this is not the case and what seem to be more practical considerations hold sway.

things that are thought to have been scientifically proven are considered to be true.[3] And, even this has come under attack by so-called postmodernists and others.

The high degree of subjectivism that taints the modern world view was startlingly revealed not so long ago by physicist Alan Sokal. Frustrated with the subjectivist attitude in the humanities, he wrote an article arguing for the conclusions that the humanities community wanted to hear, apparently using the latest discoveries of modern physics. In fact, he knew that the conclusions did not follow from the premises, and the article is full of hilarity for physicists. Despite its (intentional) non-sequiturs, the article was accepted for publication and hailed by many as an important work. Sokal later revealed his hoax to the consternation and even disbelief of many.

Yet, despite science's truth-centeredness, science itself seems to be the source of the skepticism about our ability to know. Indeed, in the ensuing firestorm between the humanities and the sciences, one historian of physics turned the tables on Sokal to say "At Whom Are We Laughing?," [4] pointing to quotes from prominent physicists apparently reasoning just in the way Sokal mocked.

What's more, there are examples of misunderstanding apparently coming from the heart of the sciences. By invoking Newtonian mechanics, many argue that motion doesn't need a cause; this comes from Galilean relativity in which uniform motion appears on equal footing with rest, one being transposed into the other by a change of reference frame. This challenge to causality occurred long before quantum mechanics came along and apparently taught many that causality is completely unreal and in fact that the world is not there until you look at it.[5] In addition, quantum mechanics does introduce the idea of indistinguishable particles that is often spontaneously translated to an ontological indistinguishablity, i.e. that there is such a thing as an *individual particle* (e.g. an electron) that has no *individuality*! Special relativity teaches us that "now" is also relative to a given frame, so that we apparently have no need in it to talk of a common "now;" in fact it goes against the spirit of the system to pick out one "now" over another. These conundrums can be unwound (though the process has really only begun),[6] but they are only the tip of the iceberg.[7]

The Path to a Culture of Philosophic Idealism: Scientism

In the broad picture, the success of modern science has, unintentionally, brought with it the success of the most insidious of the skeptical philosophies, philosophical

[3] We see the high place given science in popular culture, for example, in Time's naming Albert Einstein the man of the century and the general popularity of Einstein as the symbol of high intelligence.

[4] Mara Beller, "The Sokal Hoax: At Whom Are We Laughing?" Physics Today 51, no.9, (1998): pp. 29-34

[5] For instance, Cornell physicist N. David Mermin says, "We now know that the moon is demonstrably not there when nobody is looking." James T. Cushing and Ernan McMullin, eds., Philosophical Consequences of Quantum Theory (Notre Dame, Indiana: University of Notre Dame Press, 1989), p. 49.

[6] This unwinding is part of the work of the Institute for Advanced Physics, which I will speak more about later.

[7] Note that most physicists typically know the limits of their science and don't talk outside its realm of applicability; however, there is a real need to understand more than the narrow domain accessible to the specialized sciences, so there inevitably is a philosophical transposition that naturally happens as the highly mathematical technical field is transposed to common language, a process which is philosophical and thus, by default, not something the physicist has training in or facility with.

idealism (of a hardened type that is peculiar to modern thinking).[8] Hume, for instance, basking in the success of Newton, summarized the effort to adopt a purely modern scientific mindset when he said if it isn't mathematical or experimental "commit it then to the flames: for it can contain nothing but sophistry…" [9] Experiment, in this general view, does not include basic everyday observation, no matter how careful. *Specialized science, especially that which involved quantitative measurement and theory, was becoming the first and only form of knowing, displacing, so it seems, any knowledge directly evident to and through the senses.*

If we really were to start with modern scientific methodology as the only form of knowing, one would be trapped in a vicious circle. For in the method of 1) make hypothesis, 2) test hypothesis by experiment, 3) reform hypothesis, where will the meanings in the first hypothesis come from? What specialized experiment can we do to prove that things exist, or the idea of "big,"[10] or the idea of "two" or the principle of causality? These things are seen through simple use of the senses, not found by experimentation, or built from correcting previous hypotheses. Ignoring these initial insights that form the basis for the simple generic conclusions of the "Science before Science"[11] that is the implicit ground of the modern sciences became increasingly common as science moved forward from Newton's watershed publication of the Principia. Thus, modern science gradually became, in the minds of many, the first science, the starting science. Again, the direct insights and conclusions of the science before modern science, i.e. the science which studies the staring points of our understanding of reality, which comes via the senses, are the source of all of our other conclusions.

Immanuel Kant properly described (without realizing it) what happens when one leaves out this ground. That is, Kant, enamored with the success of Newtonian physics, built a system of philosophy that takes the scientific method as the starting science--not as the middle or end science that it is—and showed that one couldn't know the thing itself. How then do we know there is a thing, anything? Indeed, what then are we talking about? Unbridled skepticism here reaches its peak implicitly but not yet explicitly. Kant would not yet say what necessarily follows from his philosophy. Others would.

The tremendous growth in modern science and its associated technologies, though not the only factor, is clearly the driving factor in the epidemic of skepticism that has

[8] We can summarize the modern view as follows: The material world is all there is and that's only in your mind.

[9] David Hume, "An Enquiry Concerning Human Understanding," in Harvard Classics, vol. 26 (P.F. Collier & Son,1910), last paragraph

[10] Technically, of course, one does not prove meanings (like "big") but propositions. However, our modern (philosophical idealist) mindset is such as to expect if something is known it is only known by proof (indeed proof in a modern mathematics type sense). It is thus instructive to phrase our question as above, that is, in the way which our inborn tendency draws us to phrase it. In this way, we quickly see its limit within the context of our thinking. In particular, we see that there are and must be ways of knowing other than proof from axioms. Namely, we must have direct insight into some things. We, for example, know "big" because we've seen big things. "Big" is not a concept waiting for experimental verification to determine whether it is real. It is a (relational) property (of some thing) that we have seen directly through our senses. (Later, after getting the concept, we may, of course, wonder if "some other thing is big or not.") Indeed, only when we focus on meanings rather than formal structure can we clearly see the meaning of "proposition" and thus the meaning of "proof."

[11] See Anthony Rizzi, The Science Before Science: A Guide to Thinking in the 21st Century.

spread wide and deep. Now, we know that every error is a privation of a truth. The greater the truth, the greater is the possibility of error, for the more there is to a thing the more there is to leave out or distort. We should thus look for a great truth animating our culture, the perversion of which is driving the error of philosophical idealism that dominates our mindset. Well, it is science that animates our culture as it (in the general sense of scientia or knowledge) does every culture; we always act on what we think we know. In our culture, as we've noted, that which is considered known is only that which can be shown scientifically.

Scientists seek and find many important truths. This is the clear testimony of its history over these same centuries. Thus, it seems at first paradoxical that it could be the source of the problem. It seems we have a good *scientia*, a good head of our culture. Implicitly, it is, but too much is left implicit and unanalyzed. The key problem, as we alluded to above, is that an explicit base is missing. We, like Hume, tend to take modern science as the starting point for all knowing. Thus, in terms of explicit understanding, we are standing in mid-air.

Non-scientists seldom know enough science to understand for themselves (through following its reasoning and experiments) what science really is and how it arrives at its conclusions. They take it on faith. Now, faith based on authority is a necessary and important part of human existence. Indeed, for instance, no scientist can do all the experiments and reasoning involved in modern science himself, so he too must take much on faith as well. However, many are not conscious that theirs is faith based on authority. For instance, in a simple case, most think they *know* the earth revolves around the sun, but few can begin to say why this is true when all immediate evidences appear to be to the contrary. Only when asked do they begin to realize that they don't know it, but believe it. That is, most think it personal knowledge but it's actually belief. This makes it a blind faith. Can one imagine a more powerful form of control than to get someone to think that he knows something of his own personal understanding when actually he is taking it solely on the controller's authority? Any admixture of philosophical error thus is swallowed along with the truth of science with very little sifting possible.

Examples of the problems are easily seen in popularized versions of science. But, as we glimpsed earlier, the problems appear whenever the philosophical side, i.e. the meaning, of science is discussed, that is, when the full contextual meaning of modern science is discussed. The problem lies in the disjunction between philosophy and science.[12] There is still at least one relic of the former unity of the two that everyone has seen. Namely, some have PhDs in physics; others have PhDs in chemistry, etc. The titles mean doctor of philosophy in physics and in chemistry. The integrated ancient view was that they were one for truth is one. Knowledge was considered one. There was no science given the job of figuring out what the other fields really mean. Each specialist in a given field was expected to truly know, not everything about everything, but the full meaning of what he was doing.

[12] Popes have consistently pointed to the generic problem of the need for proper philosophy in modern times, from Pope Leo XIII in Aeterni Patris to St. Pius X in Doctoris Angelici to John Paul II's letter (June 1, 1988) to the Vatican Observatory calling the problem (the proper philosophic digestion of modern science) more urgent than was the introduction of Aristotle in the middle ages to our present Pope's comments at Regensburg on September 12th of this year (2006).

Moreover, each specialist should recognize what he inherits from the fields upon which his field rests and should carry those principles through the whole structure of his field at least in putting proper context to its discoveries. A field with this kind of integrity makes for a stable interaction between sister fields and, even more importantly, a solid foundation for daughter fields. Indeed, even before speaking about the broader ontological grounding and context of the modern sciences, it is, for instance, already true that a chemist who understands something about the quantum mechanics given to him by physics will be a better chemist, all else being equal, than one who does not. However, this is only a merest glimpse of the deeper need for a grounded, fully[13] ontological understanding of reality in the sciences.

The source of the destabilizing confusions manifested by the state of the culture outlined above is fundamentally related to the mode of activity of the modern sciences which Jacques Maritain called empiriological and others have more vaguely called the scientific method. It's not the mode itself that's the problem, but the lack of explicit understanding of it, where it is grounded, and the context of its discoveries. The understanding is not lacking, just not explicit and formed, but confused. A firm base is needed.

In the base science of physics, the mathematical rigor so characteristic of modern thought comes to the fore. It is here that the scientific method had its first real success and continues to be considered the highest standard of rigor available. Physics is not only the base of the modern sciences, but also is, when used in the broadest sense of the term, the beginning of all thinking.

Our knowledge, as St. Thomas Aquinas and Aristotle point out, begins in the senses. We sense physical things, so obviously physical things are the first things we know. Thus, we need to get our physical understanding right, because everything else we say will be in analogy to that which we know directly through the senses. Physics, in the general sense to be made more precise below, is the rigorous study of the physical world beginning with the things we sense directly. To the degree our physics, in this general sense, is distorted or wrong is the degree to which our knowledge in other areas will be wrong or distorted. This broad meaning of physics is now largely lost; the modern meaning is generally a thin meaning. It's thus very important to get this meaning right, so as to properly assess the problem and its solution.

Clearly, this does not mean everyone needs to understand all of physics to live a good life in the 21st century. It does mean, however, that every educated person should understand the base principles upon which all of our understanding rests. Conversely, it also means that a thin, confused base physics will continue to destabilize all of our knowledge, as it has done for centuries.

What is Physics?

Physics in the general sense is obviously the study of the physical world, i.e. changeable being (ens mobile). Practically no physicist would recognize the later clarification. This is because, though modern physics still explores changeable being, it does so largely (through centuries of honing the habit of an extremely powerful method), by looking at the physical world (*empirical*) as mathematical (as measured, *metric*), or

[13] In so far as this is possible at a given time, cf. footnote 16.

*empiriometric*ally in Maritain's terms. Its main output then is an equation. In Newtonian mechanics,[14] the main output, for instance, is two equations $\vec{F} = m\vec{a}$, $\vec{F} = \frac{GMm}{r^2}\hat{r}$; experiments and thinking within this domain center around them. Mathematics, it is thus said, is the queen of the sciences. Now, modern mathematics is not understood in the same way as the ancients understood it. In fact, the great 17th century revolution in physics was preceded by a great revolution in math, what might be called the logicization and symbolization of math which allowed a sort of merging, through beings of reason, of geometry and arithmetic. In analogy to the scientific revolution, in which the empiriometric method came to maturity, Descartes and others initiated a revolution in math. Whereas the ancients took an approach that focused directly on the reality under consideration (quantity for the mathematicians), these innovators shifted to a system approach that emphasizes symbols and method. As Newtonian physics was, in a real way, the birth of modern science, Descartes' (and Vieta's and others') symbolization and logicization was the birth of modern mathematics.[15] I call this new approach that characterizes modern math *quantiological*. Wherever one places its beginning, it is a very important shift from ancient thinking about mathematics. Indeed, these breakthroughs in mathematics and physics, let it be said emphatically, are immensely good and are each, *of themselves*, happy events.

With the new maturity of the empiriometric method, physics seeded a wealth of new ideas in mathematics and mathematics provided crucial tools and insights for physics. Calculus, for instance, came along with Newton's effort to understand the physical world.

Thus, this new physics looks at the world as mathematical and finds so many new things about the world by this casting of the physical into the first accident of every physical thing, quantity. The quantities of modern physics are obtained, by analogy with the quantity (in particular "number") seen in or abstracted from the first accident, through use of detailed measurement.[16] These measurements are understood through systems of mathematics around an equation(s) that serves as the formal component for the theory. In this way, new results are attained at accelerated rates as witnessed by anyone who follows physics.

The empiriometric method works so well in modern physics for two key reasons. First, since quantity is the first accident of material things, we expect it to be revelatory of all the other eight categories of properties of material things (quality, relation, action, reception, place, orientation, environment and time) and thus of the essence of the substance itself. Second, modern physics looks at simple physical things in which the qualitative element is much less prominent relative to the quantitative because they are

---

[14] It is called Newtonian, because Newton was its primary architect, not because it's in the same form as Newton originally conceived.

[15] Of course, these men could not, as Newton aptly noted of himself, have seen so far had they not themselves "stood on the shoulders of giants." Both had medieval predecessors and contemporaries that had already seen and pointed out many, if not all, of the different pieces that were to come together to make the entire puzzle. It took, however, a man of genius, such as Galileo, Newton and Descartes, to come along at the right time and recognize the unity that the various pieces form, point it out and make use of the new insight in a profound way.

[16] For more detail on the empiriometric method and modern physics, see Anthony Rizzi, The Science Before Science: A Guide to Thinking in the 21st Century.

lower in the scale of being; for example, elementary particles have a much less robust qualitative side than say, for instance, a living organism. Hence, the quantitative is, so to speak, a much larger part of the thing and thus more directly revelatory of the form. Those things that are not ripped down to simple components like atoms or elementary particles are still looked at in their most general terms, leaving aside those more robust qualities that complicate the situation. In this way, quantity again comes to the fore, though of course in more complex substances like living things, we probe their essence hardly at all with this method. Yet, we can say important general things about them because, for example, they incorporate and make use of, not annihilate, the powers of those substances below them from which they are made.[17]

From this it is clear that the empiriometric approach, though it is *crucial* and needs to be more widely appreciated and respected because of its high importance, is not the whole story, for the physical world is not completely castable in mathematical terms for it is not merely mathematical. Each substance has, as we mentioned, all the other categories of properties of physical things. Physics, of course, is constantly using these aspects, but often only implicitly (a physicist can talk only briefly before, for instance, mentioning "relation" or "quantity," but his understanding of these words is only confusedly related to the respective categories). Indeed, substance and essence are usually kept only implicitly as well. It is in this area that the problem, and its solution, lies. Physics should be the study of the physical world in all of its aspects and it should be so explicitly, not just implicitly and confusedly.[18] To the degree that it doesn't do this explicitly, it has not yet reached the level of scientia.

The Building of Habits of Idealism

The heavy use of beings of reason to express the real within modern physics leads to insensitivity to the distinctions needed to build the base of our thinking firmly and clearly. Physicists, and I'll speak from personal experience here, are in one way, that is in our gut, in our implicit spontaneous understanding, the most firmly planted realists you can meet, but the clarity and full rigor of our *thought* is largely in the empiriometric mode, not in the fully ontological notions. This habit of mind, in turn, is related to, but by no means limited to, the modern heavy leaning on the axiomatic approach to mathematics.

[17] It is precisely for this reason that as one moves away from the consideration of the physical in these simple and/or generic modes that the empiriometric method works less and less well. In the realm of intellect and will (as opposed to the sensorial powers), one is in a purely nonmaterial realm (which doesn't have the first accident of quantity) in which the method should *not* be expected to have much power at all. This has not deterred our scientistic culture (largely because it is not understood) from trying, because of the success of physics, to force this nonmaterial realm into the empiriometric mold and even to think, despite substantial evidence to the contrary, that such use of the method has the same certainty as the physics conclusions.

[18] Of course, in some cases we will not be able to more clearly articulate the meaning, but this will not obviate our need to set the context and limits until more experimentation and empiriometric work is done to shed light on the given issues. This can only be adequately done by physicists that know philosophy, especially the foundational *physica*. Such background will allow them to have fruitful discussions with Thomists that know metaphysics and thus to get generic guidance themselves while giving the metaphysicians food for thought.

Historically, Descartes' insights lead through gradual evolution to the modern formal axiomatic-symbolic method in logic as well as within mathematics proper. By the turn of the last century, modern mathematics was already so heavily axiomatized[19] in its habits that Bertrand Russell could say that mathematics is a subject in which "…we never know what we are talking about, nor whether what we are saying is true."[20] Ultimate thought was about formal systems. So much so that David Hilbert, with the help of Kurt Gödel, attempted to prove that all propositions within a system of mathematics could be proved within that system. In other words, we sought to prove, in a way, that we could live inside of our heads, picking up ourselves by our bootstraps. Not surprisingly, Hilbert's ambitious project failed, for Gödel not only found that there could be propositions which could not be proved within such a system[21] (and that we could know them true in some logic sense despite this) but that one could not even prove that the system was self-consistent.

Indeed, such habits of thought (i.e., oriented towards working in formal systems) are, as we've said, good and beneficial in their own domain. However, such habits of thought can lock one out of noticing the larger realities from which these systems are created and lock one into Cartesian philosophical idealism, in which one tries to argue from the ideas within one's head to the existence and nature of the outside world. From here it is only a short skip to the fundamentally Kantian idea that our mind forms reality. Indeed, I think that Descartes' own genius and work in mathematics, which formed his habits of mind, were crucial in the formation of his philosophy and his extraordinary confidence in his philosophical approach. In the same way that his mathematico-logical-symbolic habits led him to start his thought with thought (i.e. in his head), our even more refined and more ingrained empirio-logical[22] habits lead us, under the aegis of cultural pressures coming from these same habits, to philosophical idealism. It's why the modern mind spontaneously latches on to Cartesian idealism despite the fact that few have actually read any Cartesian philosophy. Physicists certainly aren't trained in it. Yet, the empiriometric mindset breeds an unasked for affinity to it.

Few realize the depth of this problem because of the split between the sciences and the humanities, the "two cultures," as C.P. Snow aptly called them.[23] Those in the humanities generally do not understand nor even really see the modern (empiriological) scientific mindset for two reasons. First, they do not know the science itself, but the transposition of the science from its native form to popular language. Second, they are themselves formed by the philosophical idealism (which is unwittingly driven by the sciences). Thomists and others with robust common sense, not knowing the empiriometric method and its power from the inside, cannot see how scientists could seriously mean some of the things they say, and so, because they don't understand the

[19] For more depth on the nature of axiomatic math see: Anthony Rizzi,"What Does Math Mean Really?", publication pending.

[20] From Russell Archives (http://www.mcmaster.ca/russdocs/brquotes.htm) which gives: *CPBR* 3: 366 : 31-3 ("Recent Work on the Principles of Mathematics", a.k.a. "Mathematics and the Metaphysicians")

[21] More exactly, within a formal system at least as complex as arithmetic.

[22] The word *empiriological* is Jacques Maritain's generic term for the mode of practice of modern sciences in which the physical is cast in some way into the logical domain. It includes the *empiriometric* and the *empirioschematic* methods.

[23] The "two cultures" are apparently most widely known from Snow's 1959 Rede lecture. The issue here is not the specifics of Snow's thesis, but the real split between the humanities and the sciences.

depth of the ingrained habit formed in scientists by years of training, working and thinking in a largely empiriometric domain, they tend to underestimate the size of the problem, often concluding that a series of extended conversations with good Thomists (who don't know physics) would straighten out the problem. Other non-scientists, also not seeing the deep intellectual questions and confusions that need to be addressed, emphasize the will and tend to think a conversion of the will from evil to good is all that's needed.

Scientists for their part, almost universally, are only exposed to *modern* philosophy, and they generally find it to be only games with words, as Richard Feynman said after attending a philosophy conference. As for Thomism, few scientists know any real Thomists, but when they do come into contact with them, they find them hopelessly (so they think) stuck in ancient ideologies that they thought science had successfully overthrown. Even more, they will tend to think that it's only through such a philosopher's ignorance of modern science, that he may hold such "classical" notions. Seeing how little physics the (typical) Thomist knows and how little argument he *apparently* has against simple physics-based objections, they leave the conversation unconvinced at best, but usually wishing for more universal physics education to stomp out such ignorance. Indeed, the ignorance of physics of most Thomists is real to the extent that most of the specific challenges of modern physics have been left largely untouched by Thomists. Of course, the specific challenges cannot undo the generic answers, which have been made very well by many Thomists.

In short, the truths of each side (human truths on one side, scientific truths on the other) are, for these reasons, invisible to the other: hence, the split. Fights can and do ensue. Each time the scientism, the misunderstanding of the science which tends toward philosophical idealism, gains another victory, it looks more and more as if uncertainties plague anything that cannot be reigned in by the empiriological method. Indeed, often times, those most concerned about preserving those things that most matter to men (such as the purpose of our lives under God) will attack the science itself, missing their true target which is the scientism, as happened, for example, with the earth's rotation around the sun[24] or the big bang theory. Then, when the science is further confirmed, such things as morality and God look as if they have been shown, yet again, to be subjective and indeed enemies of true understanding. The effect on the larger culture is then an increased leaning on the system thinking, the philosophical idealism in which one makes systems of thought which are analyzed only for their logical consistency. In this idealist thought, one doesn't really attack axioms for they are, for instance, freely chosen and beyond argument. In such thought, there are no possible *grounds* for agreement on first principles; therefore, we must move the argument to what will "work." This seems fine until one asks, "what it is I really want to work and why? And, how do I know it will work?" at which point the vicious circle cannot be broken, except narrowly and confusedly within an increasingly narrow empiriometric method.

For example, in defending a point of morality on radio or TV, the vying viewpoints will typically attempt to use empiriological evidence from the latest study to defend their view. Seldom will those defending traditional morality attempt to attack the basic presuppositions in play; the rules (postulates) of the game are implicitly (usually

[24] More was involved here (as well as other cases), but this essential aspect of the controversy is usually completely left out.

out of pragmatism) taken as inviolable. It is almost never noted or even understood that the empiriometric method--the heart of modern (empiriological) science--needs generic principles, moral principles in this case, as input and cannot, of itself, generate them. For instance, the generic goodness of marriage cannot be decided by a modern (empiriometric) scientific study no matter how accurate and complete. One needs a robust understanding of the nature of man and what is good for him to answer. What kind of quantitative study can reveal that his essential nature requires an immaterial (thus *non-quantitative*) human soul? Certainly, a quantitative study could likewise never prove that the primary end of marriage is to procreate men with such immaterial souls, nor man's need to love his wife and his children, nor the immaterial God for which he is made. Indeed, if civilization truly only allows empiriometric output from the hard sciences and that alone, while ignoring the base principle inputs, man builds for himself Aldous Huxley's Brave New World, a stark cold world devoid of humanity, devoid of what we truly want and need.[25] Indeed, in that world, even modern science itself ceases to be its real truth-seeking self, as Huxley prophetically points out.

The Solution

In order to reintegrate our culture, we must reintegrate our thinking. To do this we must reground our thinking, which means firmly grounding the base science of physics. We will call this filled-out, broad physics, physica. This physica must retain the generic truth of physical being articulated by St. Thomas and his disciples, but it must do so in light of the understanding of the modern hearer, in light of his scientistic habits. The modern hearer is formed by modern science. From very young he learns about atoms and space and modern approaches to mathematics. He needs to have the many nascent questions and even false philosophical conclusions that this training inevitably brings up and engenders answered and corrected, but it must be done without compromising or minimizing the truths of modern science. Doing this requires the cooperation of Thomists

[25] Forgetting the base physica and expecting the output to come automatically, without applying conscious reasoned thought to the principled input, necessarily means that the input is chosen by fiat. But, one makes a fiat for a reason, even if one does not consciously choose that reason. As mentioned earlier, these "fiated" inputs are determined "pragmatically" by what works. From the point of view of the intellectual elite of the culture, what works is then by definition what one can most easily think and process by the only accepted way to get certainty, i.e. the empiriometric method. One will thus be biased *towards* principles in which the quantitative is dominant and the qualitative less prominent and away from those which are not, eschewing those that have no quantitative aspect such as the human intellect or will. The culture will thus tend by default towards a mechanical type of materialism. But, we still have not answered what people get from following such a system. For one, they get, if successful, an ever increasing technology that potentially makes life materially more productive and easier. Indeed, from the point of view of the larger population and ultimately the elites themselves, since no concerted effort will be spent maintaining or establishing full human moral principles that most can agree to as objectively true, man will be increasingly reduced to defending the lowest common denominator, his physical and emotional well being. Without principled objective convictions to guide his action and form his character, man is reduced to an animal-like existence and more easily controlled by manipulating his physical environment. Hence, this facilitates the empiriological systems ability to make further change, while it affirms in the sphere of everyday life that the default materialist value system imposed by the narrow base *scientia*. Much more can be said, but the basic principle of a thin mechanical base physica causing a thin mechanical culture should be clear. (Note: some type of inattention to these inputs can be tolerated in modern physics because of the tight feedback with experiment that is possible because of the generic physical nature that is under study; however, this is increasingly less true as one proceeds to natures in which the qualitative is more prominent.)

and physicists. Indeed, physicists should become explicit Thomists[26] rather than implicit ones, making the base of our knowing firm and clear.

However, this is not all. Modern empiriometric physics is strewn with content that is only half articulated and often placed out of context in the full physica and metaphysica. It needs to be fully and clearly articulated and placed in the context of our knowledge, so it, and everything else we know, can become an integrated part of wisdom and the cultivation of our desire for wisdom, philosophy. This requires then not just reestablishing the roots, that is, the foundational physica, as was so well laid out by St. Thomas and his disciples, but also consciously and painstakingly carrying the nutrients and water of these principles into every part of the growth of modern science. This is no small task given that very little of it has been done. We have three or four hundred years (measured from Newton or Galileo, respectively) of growth of empiriometric physics from the dry soil of a thin physica. The base needs to be firmed up and made explicit. Then, the nutrition and hydration that are nascent in these fertile principles need to be brought up into all areas of the growth of physics to fill out what precisely is meant and what is not meant at each level and subdivision of empiriometric physics and to place that knowledge in its proper context.

We don't want to lose our well formed habits of working in the empiriometric realm that were acquired at the expense of centuries of effort, but we don't want to lose our sanity either. Of course, they can and will go together if we build a new habit of thinking that properly places and understands the empiriometric method and its output in the heart of the sciences. This is no trivial task, but requires real research and thought done right in the heart of modern physics. It requires that physicists learn fundamental philosophy and carry it into the heart of their work, curriculum and teaching.[27] It also requires that philosophers learn a little of the content of modern physics. Again, this means a real cooperation between physicists and philosophers, indeed a working side by side.[28] The Institute for Advanced Physics pioneered such detailed work and is the only organization currently carrying out such work.

Of course, we also need, as so many good Thomists have provided, a strong metaphysics that points out in broad terms where certain interpretations of science cannot be true. But, as long as the culture's physica is thin and ill-formed, the metaphysics of St. Thomas will, at best, look to the bulk of the world as one choice among many possible Kantian systems. Thus, though metaphysics is our ultimate natural knowledge and it is

[26] In the sense of grounding their thinking in the base physica, and bringing that base knowledge to bear on all their human activities, enabling them (and, through their work and understanding, also those around them) to live fully human, thoughtful lives in all areas of life, including within the heart of the work of their particular sub fields of physics.

[27] Development of teaching material, such as textbooks, is crucial. Developing such material forces one to think about the fundamental principles (and thus to do the necessary research) and clarify context, such as clearly bringing out, in the full ontological sense, what we are considering and what we are leaving out of consideration in the particular branch of physics under study. Indeed, development of such material gives a concrete program to accomplish the very integration that is needed. The material itself then, of course, serves to begin the process of building more full and conscious *habits* of thinking for the next generation of physicists (not to mention the help it provides to those that teach it).

[28] It is for this reason that I founded, and have directed for over 5 years, *The Institute for Advanced Physics*. Philosophers and physicists are encouraged to join us; in particular, IAP has a certified member program that can introduce philosophers and physicists to the specifics of this bringing of Thomist philosophy to bear on the heart of modern thinking, modern science.

absolutely necessary to promote and continue as much work as possible in learning and teaching it, it will not be properly understood and taken seriously without re-establishing the habits and explicit content of the base of our knowledge which comes to us through the senses.

The Dangers of Side-Stepping the Solution

This is the only way the dominance of the practical reason, at the expense of the truth for which we are made, can be undone. For, of course, "practical reason" is nothing but the mind applied to the question of "what should I do and how?," and that question is not answerable unless we truly know something about reality, including what its nature is at some generic level, what we are and what we are made for. Without such answers, practical decisions are, of necessity, subjective, driven ultimately by the already established order (system) of society. This, in turn, is a prescription for arbitrary political autocracy, for once arbitrary (or evil) rule is put in place, there is no *ground* for arguing that it should be changed.[29] The moment to moment pragmatism that subjectivism reduces us to drops us back to an animal-like survival mode in which we only do what it takes to live in the current system of rules. In that state, with the idealist mindset, we have no ability, and increasingly fewer habits, of grounded questioning of that system and even little awareness that there is a global understanding problem.

In the scientistic driven world, the lack of conscious ability to refute errors in the prevailing world view (indeed unconscious adoption of those principles by most) is further deepened as the newest discoveries of science seem to confirm the scientism's base principle that empiriological science is the first and only way we can know. Scientific discoveries are most emphatically made known to us through what, in their own way, can be called the sacramentals of science, new technologies.

Through these "sacramentals," we not only see proof of the veracity of the scientific method but we can learn to live the heart of philosophical idealism; i.e. that it's the symbol, not the thing represented by the symbol, that matters; it's the media, not the message. Or, as it has often been said, the media is the message. Ultimately, we tend to assign a thing a symbolic value and proceed to forget that it's first a natural thing and only afterward can it be a symbol. In this way, our ideas become solely *that which we know*, not that *by which we know things.*

Similarly, our technologies are first parts of nature then artifices that have a use, but habit and the highly complex nature of the artifice wears awareness of that fact ever thinner. For instance, nearly all end up typing on a computer, but only those with technical education have any idea what the computer really is. Most don't understand what the screen they spend so much time staring at is. As a result, there is even more tendency to look completely past the screen to the meaning we or others type on it. We don't see a screen but the thoughts of another. Or in a different realm, many think meat comes from the grocery store; many of my generation tell the story of their first

[29] The current trend is towards multiplication of rules because, with no grounded principles, a semblance of order can only be maintained by introducing regulations to keep the undesirable (to some influential group at least at the moment) effects at bay. Indeed, as a virus has many varied symptoms, a single root cause can result in many, varied evil effects. As one refuses to deal with root causes, more iron control of resulting effects must be implemented to get the desired effects.

realization that that plastic and styrofoam wrapped red stuff is actually killed cow. [30] More and more, we don't see the things in front of us, but the meanings we give them. The world, for many, increasingly becomes evaporated into man's self-made universe of which increasingly the only reality we concentrate on is the self.

With our scientistic mindset, as we become better and better at creating systems of our own making, our culture becomes more mechanical and more system-driven in which rules, in positivistic fashion (i.e. without needing grounding but only force of governmental law) are the only norms. It becomes, as Malcolm Muggeridge aptly described,[31] a concrete landscape with no room for the smallest amount of grass to grow even in the crevasses; it's no wonder Mother Teresa described the West, the source and powerhouse of science, as having the poorest of the spiritually poor. Nature becomes opaque and gradually, for us, only the meanings we give her and that into which we make her parts are real. We learn to live in a virtual reality akin to that in the movie The Matrix. The fact that nature is ultimately behind all we do recedes into the background and our making and doing becomes the first and, finally, the only reality. The increasing pressure between our system-building world view (and the world that we create based on it) and our own true nature and needs strains our very selves until as Jacques Maritain says "it is quite believable that the shape of this world will pass away on the day that this tension becomes so great that our heart will break."[32]

With a renewed commitment to what really works for the good and not just what works within the given system, we, like a good engineer, can go about getting done what's essential--and no less than what's essential--namely reestablishing the roots of our scientific thinking and bringing them into dynamic play in the scientist's life and work. Like a good mechanical engineer, we know if the laws of physics are not obeyed, our best motivation will not keep the bridge we make from falling or even possibly from ever being successfully constructed. We thus take no part in the illusions of the positivistic system builders so well brought home in the story of the woman who couldn't find her earrings and when asked why she was looking in the kitchen rather than the living room where she had lost them said, "The light is better in here."

There is no reason why we cannot, with God's help, bring our common sense thinking and science into focus as parts of the one truth. We have four hundred years of momentum to overcome and four hundred years of work that has piled up, but it is also an opportunity for exciting new understandings to which those who came before us did not have access.

[30] Of course, these things would not be so big a problem in a more philosophically well-formed culture.
[31] He described this in another similar context.
[32] Jacques Maritain, The Degrees of Knowledge, (New York: Charles Scribner's Sons, 1959), p. 15.