

SCIENCE AND THEOLOGY

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Resumo: A influência da ciência na vida moderna é enorme, e passou a dominar nossa intelectualidade. A teologia efetivamente foi rebaixada e para muitos possui somente um papel secundário na busca do conhecimento. De fato, geralmente tal atitude provém de uma incompreensão do conhecimento da ciência, do conhecimento científico e da teologia. Existem oito aspectos nos quais a ciência difere da teologia e estes fornecem a chave para o correto entendimento do relacionamento entre essas duas formas de conhecimento: (1) O objeto de cada conhecimento; (2) Suas respectivas formas de investigação; (3) Os níveis de conhecimento que cada uma envolve; (4) Os níveis de realidade nos quais cada uma delas opera; (5) O número de níveis nos quais cada uma das respectivas afirmações pode ser entendida; (6) Os objetivos de cada uma; (7) Suas respectivas fontes de conhecimento e correspondentes autoridades; (8) Seu uso da postulação da realidade. Ao examinar esses aspectos, passa a se tornar claro que nem a ciência nem qualquer outra forma de conhecimento é capaz de apreender o todo da realidade. Ou seja, o conhecimento humano da realidade nunca pode ser completo, ainda que baseado na filosofia, na ciência, na literatura ou em qualquer outra forma de conhecimento em nível de razão. A ciência utiliza uma metodologia particular e um critério de realidade para que possa proceder; ambos são objetos de revisão e o critério pode variar dentro dos diversos campos científicos. Nenhuma delas pode ser provada dentro da ciência propriamente dita; a metodologia só poderá ser julgada no contexto total do conhecimento humano, e o critério da realidade (científica), em última instância, é um subconjunto da realidade geral, total. A teologia, como a filosofia, utiliza a razão humana baseada em nosso contato direto com a realidade. No entanto, ela ainda possui outras fontes, a revelação, em particular, as quais lhes

concedem uma autoridade que outras formas de conhecimento não possuem. E finalmente, a teologia vê além da ciência, para ultimar a realidade, e ainda vê coisas ordinárias a um nível inacessível para a ciência.

Palavras-chave: Ciência. Teologia. Realidade. Conhecimento.

Abstract: The influence of science on modern life is enormous, and has come to dominate our intellectual situation. Theology has effectively been demoted, and for many has only a secondary role in the pursuit of knowledge. In fact this general attitude stems from a misunderstanding of the nature of science, scientific knowledge, and theology. There are eight ways in which science and theology differ, and they provide the key to correctly understanding the relationship between these forms of knowledge: (1) The object of their knowledge; (2) Their respective manners of investigation; (3) The levels of knowledge each involves; (4) The levels of reality at which each operates; (5) The number of levels at which their respective statements can be understood; (6) The goals of each; (7) The source of their knowledge and corresponding authority; (8) Their use of postulation of reality. When these are examined, it becomes clear that neither science nor any other form of knowledge can capture all of reality. That is, human knowledge of reality can never be complete, whether based on philosophy, science, literature, or any other form of knowledge based at the level of reason. Science utilizes a particular methodology and a canon of reality in order to proceed; both are subject to revision, and the canon may vary from one scientific field to another. Neither of the two can be proved within science itself; the methodology can only be judged in the total context of human knowledge, and the canon of (scientific) reality ultimately is a subset of reality in general. Theology, like philosophy,

utilizes human reason based on our direct contact with reality. However, it also has other sources, in particular revelation, which gives it an authority that other forms of knowledge do not have. And ultimately theology sees beyond science, to ultimate reality, and even sees ordinary things at a level inaccessible to science.

Keywords: Science. Theology. Reality. Knowledge.

Resumen: La influencia de la ciencia en la vida moderna es enorme, y pasó a dominar nuestra intelectualidad. La teología efectivamente fue rebajada y para muchos posee solamente un papel secundario en la búsqueda del conocimiento. De hecho, tal actitud se debe generalmente a una incomprensión de la naturaleza de la ciencia, del conocimiento científico y de la teología. Existen ocho aspectos en los cuales la ciencia difiere de la teología y estos proporcionan la clave para entender correctamente la relación entre estas dos formas de conocimiento: (1) El objeto de cada conocimiento; (2) Sus respectivas formas de investigación; (3) Los niveles de conocimiento que cada una envuelve; (4) Los niveles de realidad en los cuales cada una de ellas opera; (5) El número de niveles en los cuales cada una de las respectivas afirmaciones puede ser entendida; (6) Los objetivos de cada una; (7) Sus respectivas fuentes de conocimiento y correspondientes autoridades; (8) Su uso de la postulación de la realidad. Al examinar estos aspectos, se hace evidente que ni la ciencia ni cualquier otra forma de conocimiento es capaz de aprender el todo de la realidad. Es decir, el conocimiento humano de la realidad nunca puede ser completo, ya sea basado en la filosofía, la ciencia, la literatura o en cualquier otra forma de conocimiento basado en el nivel de la razón. La ciencia utiliza una metodología particular y un criterio de realidad para que pueda proceder; ambos son objetos de revisión y el criterio puede variar dentro de los diversos campos científicos. Ninguno de los dos puede ser demostrado dentro de la ciencia propiamente dicha; la metodología solo podrá ser juzgada en el contexto total del conocimiento humano, y el criterio de la realidad (científica), en última instancia, es un subconjunto de la realidad general, total. La teología, como la filosofía, utiliza la razón

humana basada en nuestro contacto directo con la realidad. Sin embargo, también posee otras fuentes, en particular, la revelación, las cuales le conceden una autoridad que otras formas de conocimiento no poseen. Y finalmente, la teología ve más allá de la ciencia, a la realidad última, e incluso ve cosas ordinarias a un nivel inaccesible para la ciencia.

Palabras clave: Ciencia. Teología. Realidad. Conocimiento.

Sommario: L'influenza della scienza nella vita moderna è enorme, ed è riuscita a dominare la nostra dimensione intellettuale. La teologia effettivamente ha perso valore e per molti ha assunto un'importanza secondaria nel processo conoscitivo. Normalmente questo atteggiamento è causato da un falso concetto di scienza, di conoscenza scientifico e della teologia. Esistono otto aspetti che distinguono la scienza dalla teologia e questi forniscono la chiave per la corretta comprensione della relazione tra queste due forme di conoscenza: (1) L'oggetto dei due tipi di conoscenza; (2) Le loro rispettive forme di ricerca; (3) I livelli di conoscenza che le due comportano; (4) Le dimensioni della realtà nelle quali esse operano; (5) Il numero degli aspetti nei quali ciascuna delle rispettive dichiarazioni possono essere comprese; (6) I loro obiettivi; (7) Le loro rispettive fonti di conoscenza e le autorità competenti; (8) L'utilizzo dei postulati della realtà. Esaminando questi aspetti, diventa chiaro che né la scienza, né qualsiasi altra forma di conoscenza è in grado di conoscere pienamente la realtà. Vale a dire che la conoscenza umana, nonostante possa utilizzare basi solide come la filosofia, scienza, letteratura o qualsiasi altra forma di conoscenza razionale della realtà, non può mai essere completa. La scienza, nel suo procedere, utilizza una particolare metodologia e criteri particolari della realtà; entrambi sono soggetti a revisione, nonché i criteri possono variare nei diversi campi scientifici. Nessuna può, però, essere provata come la scienza effettiva richiede; La metodologia potrà essere giudicata solo nel contesto totale della conoscenza umana, e il criterio della realtà (scientifica), infine, è un sottoinsieme della realtà totale generale. La teologia, come la filosofia, usa la ragione umana sulla base di

un diretto contatto con la realtà. Tuttavia, possiede altre fonti, soprattutto la rivelazione che gli garantisce un'autorità che le altre forme di conoscenza non possiedono. E, infine, la teologia va oltre la scienza, permette vedere e definire le dimensioni più profonde della realtà ad un livello inaccessibile per la scienza.

Parole Chiave: Scienza. Teologia. Realtà. Conoscenza.

Résumé: L'influence de la science dans la vie moderne est énorme et a passé à dominer notre intellectualité. La théologie a été effectivement rebaissée et, pour beaucoup, elle a une rôle secondaire dans la recherche de la connaissance. En fait, généralement telle attitude s'origine d'une incompréhension de la nature de la science, de la connaissance scientifique et de la théologie. Il y a huit aspects où la science diffère de la théologie - ils nous donnent les clés pour une correcte compréhension de la relation de ces deux formes de connaissance : (1) L'objet de chaque connaissance ; (2) Leur formes d'investigation ; (3) Leur niveaux de connaissance ; (4) Les niveaux de réalité où chacune opère ; (5) Le nombre de niveaux où chacune des affirmations peut être comprise ; (6) Les objectifs de chacune ; (7) Leur sources de connaissance et les autorités correspondantes

; (8) Leur utilisation de la postulation de la réalité. À examiner ces aspects, c'est clair que ni la science ni autre forme de connaissance est capable de appréhender la réalité dans son ensemble. C'est-à-dire, la connaissance humaine de la réalité ne peut jamais être complet, même si sur la base de la philosophie, de la science, de la littérature, ou de n'importe quelle forme de connaissance aux niveau de raison. Pour procéder, la science utilise une méthodologie particulière et un critère de réalité; tout le deux sont objets de révision et le critère peut varier dans les divers domaines scientifiques. Aucune d'elles ne peut être prouvée dans la science elle-même; la méthodologie seulement pourra être jugée dans le contexte total de la connaissance humaine, le critère de la réalité (scientifique), en fin de compte, est un sous-ensemble de la réalité totale, générale. La théologie, comme la philosophie, utilise la raison humaine sur la base de notre contact direct avec la réalité. Cependant, elle a encore d'autres sources - la révélation, en particulier - lesquelles le donnent une autorité qui n'est pas présente dans autres formes de connaissance. Et finalement, la théologie voit au-delà de la science, pour finaliser la réalité, et voit encore des choses ordinaires dans un niveau inaccessible à la science.

Mots-clés: Science. Théologie. Réalité. Connaissance.

INTRODUCTION

The influence of science on modern life is enormous, and for many, it has displaced all other forms of knowledge, becoming the only sure road to truth, or such truth as is humanly attainable. In this sense it has come to dominate our intellectual situation, and in the process has given rise to many philosophical theories that are not science themselves but are put forth as such, or as possessing the same degree of veracity. This process began in the 18th century, and has continued and indeed accelerated, especially in the 20th and 21st centuries, with the result that many have abandoned religion, or keep its pronouncements at arm's length, believing that it plays only a secondary role in the quest for truth:

During the modern era, since about 1700, man has lived so persuaded that reality is discovered to him by science that nothing seems able to make him even notice the existence of this basic persuasion. For him, there is no room for the least doubt about it. Perhaps science happens to be somewhat fragmentary and changeable; but modern man sees in these two characteristics something more than a sad human condition: he has elevated them to the category of formal structure of science, and has thus made science a constitutive approximation to reality¹.

This enthronement of science has extremely profound consequences, for it implies that "...everything there is in reality which is accessible to man, has to be so in a way eminently scientific"². This rise of scientism can be ascribed not so much to rationalism or to any positivistic critique of knowledge, but rather to the profound conviction that has grown in Western Civilization that through science man attains the only parcel of reality which is accessible to him with certainty:

¹ ZUBIRI, Xavier. *Naturaleza, Historia, Dios*, 6th Edition, Madrid: Editora Nacional, 1974, p. 63; English edition, *Nature, History, God*, translated by Thomas Fowler, Lanham, Maryland: University Press of America, 1982, p. 59.

² Ibid.

...at the bottom of all these attitudes lies the profound conviction that the fate of reality accessible to us depends ultimately upon the fate of science, at least in respect of intellectual apprehension. And if in fact man has any other contact with reality, it would have to be through some sort of irrational intuition³.

But not everyone accepts this enthronement of science. Some have rebelled against it, especially in recent decades. Primarily fundamentalists, they reject key parts of modern science based on a literal interpretation of scripture, which they believe has higher authority. Though poorly represented in academic circles and among the more educated, the fundamentalists enjoy widespread support in the population at large. Unfortunately this has reinforced the belief of many that religion is indeed anti-science, untrustworthy, irrational, or all three.

Our present situation is thus analogous in some ways to that faced by the early Church, confronted with the enormous legacy of Greek philosophy, which at the time (and again in the Middle Ages) was considered the repository of real knowledge, despite its incompleteness and internal inconsistencies. For some, as St. Paul discovered on the Aeropagus⁴, Christianity was just too irrational compared to Greek thought. Others accepted Christianity and wanted to throw all Greek learning overboard. Fortunately, a different view prevailed, and in fact was developed very early in the history of the Church by Fathers such as St. Justin (c. 100-165). Justin recognized that individual truths, and bodies of truth, are just part of a larger whole truth:

For whatever either lawgivers or philosophers uttered well, they elaborated by finding and contemplating some part of the Word. But since they did not know the whole of the Word, which is Christ, they often contradicted themselves.... For each man spoke well

³ ZUBIRI, Xavier. *Naturaleza, Historia, Dios*, p. 64; English edition, p. 59.

⁴ Acts 17:16-34.

*in proportion to the share he had of the spermatic word, seeing what was related to it. But they who contradict themselves on the more important points appear not to have possessed the heavenly wisdom, and the knowledge which cannot be spoken against. Whatever things were rightly said among all men, are the property of us Christians*⁵. [italics added]

The role of the philosopher and the theologian is to show, insofar as it is possible, how all truths fit together. The fragmentary nature of human knowledge will prevent us from ever fully realizing this goal; but it must be done in every age. In our age, the challenge is with respect to science.

Fortunately, scientific developments since the beginning of the 20th century have given us a far better understanding of the nature of science than was possible before. As a result, we have much keener insight into the capabilities and limitations of science, the nature of reality, and the interaction among science, theology, and philosophy. Indeed, 150 years ago the kind of insight we now have would not only have been impossible, it would have been regarded as absurd. In those days, a strictly deterministic view of science was universally accepted, according to which an observer (“Laplace’s Demon”) who know the positions and momenta of all particles in the universe, and Newton’s Laws, could predict the entire future course of the universe, and retrodict its entire past. That view is what now looks absurd, in light of our understanding of chaotic behavior and quantum theory—disciplines unknown in the late 19th century.

An understanding of the proper relationship between science and theology is critical for any systematic theology in the 21st century. The alternatives are an irrational, emotional religion (as paganism by and large was), or some type of fundamentalism. A response is indeed possible, and in fact the response is that science and theology differ in eight critical ways:

⁵ ST. JUSTIN, *Second Apology of St. Justin Martyr*, 10, 13. <http://www.newadvent.org/fathers/0127.htm>.

1. The *object* of their knowledge
2. Their respective *manners of investigation*
3. The *levels of knowledge* each involves
4. The *levels of reality* at which each operates
5. The *number of levels* at which their respective statements can be understood
6. The *goals* of each
7. The *source of their knowledge and corresponding authority*
8. Their use of *postulation of reality*

These will be discussed below. But science and theology are not absolutely separate: both start from fundamental human experience, both deal with the same real world, and both make pronouncements about reality. Conflict is thus possible, and indeed inevitable unless some careful distinctions are made. Science has radically altered our view of the world, from the heliocentric theory to the Uncertainty Principle to spacetime and General Relativity, the expanding universe, the Periodic Table catalog of elements, genetics, DNA, and evolution, just to name a few areas. In what ways do these developments impact theology? In what ways does theology remain beyond changes in scientific theories? What is the nature of the interface between science and theology? Those are the key questions for this chapter. In order to understand the relationship between science and theology, we must first understand what each does.

The usual discussion of science and religion centers on the Bible, and in particular, makes reference to certain passages such as Genesis 1:1. According to this view, the Bible is not a science textbook and does not seek to give a scientific account of the creation of the universe, the origin of life, or anything else that we commonly explain today by means of science. Indeed, it would not even have been possible for the Biblical authors to tell readers of cosmic ages (e.g., 14 billion years, the age of the universe), because they could not write numbers that large (14,000,000,000)—the concept of zero in this sense first entered mathematics in India only in the 9th century AD. We must distinguish

form and content—form is the mode of presentation using concepts and images familiar to people of the age, which was many centuries before Christ; content is what the sacred writers sought to convey:

Its purpose ultimately would be to say one thing: God created the world. The world is not, as people used to think then, a chaos of mutually opposed forces; nor is it the dwelling of demonic powers from which human beings must protect themselves. The sun and the moon are not deities that rule over them, and the sky that stretches over their heads is not full of mysterious and adversary deities. Rather, all of this comes from one power, from God's eternal Reason, which became—in the Word—the power of creation....In this Word we come into contact with the real primordial force of the world and with the power that is above all powers⁶.

This point is well-taken, and indeed the Bible is not a science text. But it does not go sufficiently far, because there have been conflicts in the past. One need only recall the Galileo affair and the great debates over the heliocentric theory. To some it appears that "...the history of Christianity over the last four hundred years has been a constant rearguard action as the assertions of the faith and of theology have been dismantled piece by piece"⁷. It seems that more and more theological statements concern symbolism, and fewer and fewer actually refer to reality, so that eventually there will be nothing substantive left—all of the miracles of the Bible, and indeed the Resurrection itself, will be demoted to metaphors, but of what? Clearly this is not an acceptable situation. To really understand the relationship between science and theology, we must first discuss in some detail the nature of science, so that its limitations and function vis-à-vis theology can be understood.

⁶ RATZINGER, Joseph (Pope Benedict XVI), '*In the Beginning*', tr. by Boniface Ramsey, Grand Rapids: Eerdmans, 1995, p. 5-6.

⁷ Ibid., p. 6.

THE NATURE OF SCIENCE

As we have noted, in today's world there is a tendency to make science into a general explanatory paradigm, encompassing and/or supplanting philosophy, art, religion, and most other fields of human knowledge. The level of conceptual confusion inherent in this position is so great that sorting it out and clarifying just what science is and can do is a daunting task. The task is made more difficult by the pervasiveness of this belief in our society, and the fact that such a belief self-referentially but illicitly converts science into something "too big to fail". Real science may be sufficiently well established that its failure is exceedingly unlikely; but the same cannot be said of philosophical systems erected upon it, which are usually the source of conflict with religion. Science is supposed to be "naturalistic", and this is often taken as its defining characteristic, whereas theology is not "naturalistic". Just what is "naturalism"? What is "naturalistic"?

A. WHAT IS NATURALISM?

We shall begin by examining some typical definitions or explanations of Naturalism:

If there is one rule, one criterion that makes an idea scientific, it is that it must invoke naturalistic explanations for phenomena, and those explanations must be testable solely by the criteria of our five senses⁸ ...scientists are constrained to frame all their statements in "naturalistic" terms ...to be able to test them⁹.

This defines "naturalism" only implicitly, of course. The following attempts to be more explicit:

Most scientists today require that science be carried out according to the rule of methodological naturalism: to explain the natural world scientifically, scientists must

⁸ ELDRIDGE, Niles. *The Monkey Business: A Scientist Looks at Creationism*, New York: Washington Square Press, 1982, p. 82.

⁹ Ibid., p. 87.

restrict themselves only to material causes (to matter, energy, and their interaction). There is a practical reason for this restriction: it works. By continuing to seek natural explanations for how the world works, we have been able to find them. If supernatural explanations are allowed, they will discourage—or at least delay—the discovery of natural explanations, and we will understand less about the universe¹⁰.

Still another formulation—again indirect—is the following:

...the most important characteristic of modern science is that it depends entirely on the operation of blind, unchanging regularities in nature. We call those regularities "natural laws." Thus, scientists seek to understand the empirical world by reference to natural law and naturalistic processes¹¹.

Let us examine some of the ideas presented here. We may enumerate them as follows:

1. Naturalistic explanations utilize only material causes (matter, energy, interactions of them)
2. Naturalistic explanations involve only the five senses.
3. "Naturalistic" and "naturalism" are opposed to (disjoint from) "supernatural".
4. There is a hard-and-fast distinction between the scientific and the non-scientific, both in object and methodology
5. Science does not allow nor is it involved with the "supernatural".
6. Supernatural explanations of phenomena do not contribute to our understanding of the universe
7. In at least some cases, either natural or supernatural explanations are possible, but naturalistic explanations are better.

¹⁰ SCOTT, Eugenie. "'Science and Religion,' 'Christian Scholarship,' and 'Theistic Science': Some Comparisons," *Reports of the National Center for Science Education*, 1998, volume 18(2), p. 30-32, http://www.ncseweb.org/resources/articles/6149_science_and_religion_chris_3_1_1998.asp.

¹¹ RUSE, Michael. "Witness Testimony Sheet McLean v. Arkansas," in *But Is It Science? The Philosophical Question in the Creation/Evolution Controversy*. New York: Prometheus Books, 1996, p. 296.

These quotations reveal aspects of naturalism that are critical for our investigation. To that we turn next.

B. WHY IS NATURALISM IMPORTANT?

As the quotations make clear, naturalism is often regarded as the key component of scientific explanation, what makes a theory or statement “scientific”. This should allow us to “wall off” science from other knowledge, keep it pure, and ensure that it is concentrated on what it is designed to do, namely determine how nature works. Without naturalism, science can easily stray or degenerate into metaphysical speculation. The further removed science is from direct contact with experiment, the more readily this occurs. By insisting on naturalism, so the thinking goes, this straying can be prevented, and metaphysical contamination of science avoided.

Thus naturalism is important because it is the salient characteristic separating science from all other forms of knowledge about the world. Naturalism can thus be used to focus science on its mission, to train scientists, and to ward off poachers—those who seek to co-opt the prestige of science for non-scientific purposes. All we need to do, therefore, is devise a suitable, unambiguous definition of naturalism. By observing how science works, what it accomplishes, what assumptions it makes, and what types of explanation it allows, it should be possible to define naturalism in a straightforward manner.

At least, this is the theory. In reality, as we shall see, naturalism is a derivative concept, based on two more fundamental conceptual structures, the *canon of reality* and the *scientific method*. Naturalism is the product of a particular way of going about the acquisition of knowledge, viz. the scientific method, constrained to work on a certain group of entities, those allowed in the canon of reality, or at least the canon of scientific reality. This relationship is illustrated in Figure 1. Therefore an understanding of naturalism requires an understanding of its components, and already naturalism is becoming more complicated than perhaps it appeared at first sight. Before beginning

the task of analyzing naturalism's components and how they work together, we need to review the two types of naturalism, how they have been used, and what assumptions they make.

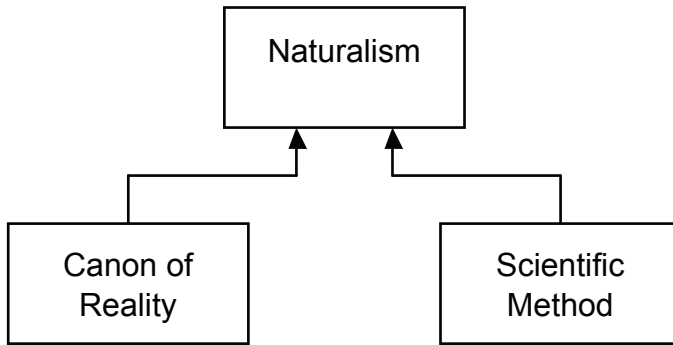


Figure 1. Genesis of Naturalism

C. THE TWO TYPES OF NATURALISM: "METHODOLOGICAL NATURALISM" AND "METAPHYSICAL NATURALISM"

In many discussions of naturalism and science there lies a distinction that is often suppressed or ignored, that between *methodological naturalism* and *metaphysical naturalism*. In essence, *methodological naturalism* states that, as a practical matter, science can only utilize explanations that involve operationally definable quantities such as mass, energy, time, and so forth. (This is easier said than done, but we shall ignore that problem for now.) Thus methodological naturalism is about the way science actually works, especially the types of explanation it can use, the acceptable range of things these explanations employ, and the logic involved in drawing conclusions that are acceptable scientifically.

At first glance, this would seem to be adequate since it gives the scope of science and meets the other goals set for naturalism. But science does seek to tell us something about reality; and metaphysics, defined as thought or explanation about reality in the deepest sense,

is not easily marginalized. In fact science does sometimes deliver new reality to us: we now know about elementary particles, genes, quasars, black holes, and dark matter because of science. Partly because of this, it is but a short step from claiming that science must be based on naturalism or naturalistic statements, to saying that *only* naturalistic phenomena exist. So if science cannot explain or describe something, it does not exist. This is *metaphysical naturalism*, because it draws conclusions about reality, about what exists. Metaphysical naturalism goes far beyond methodological naturalism and states that only “natural” things exist. As usually interpreted, it states in effect that the “supernatural” does not exist, and that all explanations of phenomena can be made by means of explanations that fall under the category of methodological naturalism. This metaphysical assertion cannot be a result of science; it is a distinctly philosophical position which must be justified on non-scientific grounds. It is, in fact, a radical form of *reductionism*, the doctrine that all phenomena and the underlying reality can be reduced to whatever it is that particle physics studies.

Unfortunately metaphysical naturalism is often proffered as a scientific conclusion or an inference from science, without explicit acknowledgment of its philosophical—not scientific—status and pedigree. Obviously, both methodological and metaphysical naturalism assume that there is a way to determine what is natural and what is not. That, unsurprisingly, is not so easy to do. Nonetheless the overriding goal of dismissing all non-scientific knowledge and entities is very strong, as the following quotation, which has achieved virtual iconic status, makes clear:

We take the side of science in spite of the patent absurdity of some of its constructs, in spite of its failure to fulfill many of its extravagant promises of health and life, in spite of the tolerance of the scientific community for unsubstantiated just-so stories, because we have a prior commitment, a commitment to materialism. It is not that the methods and institutions of science somehow compel us to accept

a material explanation of the phenomenal world, but, on the contrary, that we are forced by our a priori adherence to material causes to create an apparatus of investigation and a set of concepts that produce material explanations, no matter how counter-intuitive, no matter how mystifying to the uninitiated. Moreover, that materialism is absolute, for we cannot allow a Divine Foot in the door. The eminent Kant Scholar Lewis Beck used to say that anyone who could believe in God could believe in anything. To appeal to omnipotent deity is to allow that at any moment the regularities of nature may be ruptured, that miracles may happen¹².

But what if the crucial assumption is not true? What if naturalistic explanations *cannot* explain all observed phenomena? What if they reach a barrier? Nothing about scientific theories or explanations guarantees that they can explain everything. If they cannot, scientists would continue unperturbed in their work, but not those seeking to use science to advance extra-scientific claims. At least one important scientist, Steven Weinberg, has recognized the problem: "The only way that any sort of science can proceed is to assume that there is no divine intervention and to see how far one can get with this assumption"¹³. Weinberg's point is well-taken; we shall return to it shortly. First, let us examine naturalism in greater detail.

D. COMPONENTS OF NATURALISM: THE CANON OF REALITY AND THE SCIENTIFIC METHOD

As indicated above, naturalism is based on two important ideas, the *canon of reality* and the *scientific method*. It may seem a bit odd, at first glance, that the naturalistic depends on both the canon of reality and the scientific method. But both are essential, because not just any theory or formula with entities from the canon is naturalistic.

¹² LEWONTIN, Richard. Review of Carl Sagan's *The Demon Haunted World: Science as a Candle in the Dark*, in *The New York Review of Books*, 9 January 1997, p. 28, 31.

¹³ WEINBERG, Steven. *Dreams of a Final Theory: The Search for the Fundamental Laws of Nature*. New York: Pantheon Books, 1992, p. 247.

Consider Newton's second law, $F=ma$. This law was derived by a strictly scientific process, and then experimentally tested. We could easily write down many other equations with the same observable quantities, such as $F=ma^2$, or $F=\sin ma$. But they would not be naturalistic because they were not derived by a scientific process and do not correspond, even in first order, to any observable phenomena. They are simply mathematical fantasies.

1. THE CANON OF REALITY

Science works by utilizing a *canon* (from the Greek κανον, *rule*), which is the *set of things deemed to be acceptable as objects of science*. As discussed earlier, this is often taken in general terms as "matter and energy". The implication is that the canon can be clearly and unambiguously delineated. However, upon closer inspection, the canon of science or the *canon of scientific reality* is often hazy. For example, in medicine, there is the problem of the interaction of mind and body. What is the mind, and is it real, does it form part of the canon? Are colors naturalistic? What about other psychological phenomena, such sounds, or even dreams? While it might be relatively easy to disregard dreams, colors are more difficult. If we discount or reject colors, we are in danger of rejecting the whole basis for our perception of nature and natural phenomena.

Or consider the following question: Does prayer help people heal faster? This is a straightforward question about something that happens in the world, namely the speed of healing, which should therefore be amenable to empirical—scientific—investigation. But how would it be formulated? How would the scientist determine if someone is "praying"? Surely going through the empirically observable motions of saying certain word or holding one's hands in a particular way does not constitute what religious people understand by "prayer". But without a suitable operational definition of prayer, it is difficult to formulate a good experimental test of the hypothesis. Does this mean that the question cannot

be investigated scientifically? No. Can the question be dismissed as meaningless because religion is hokum? No, because such a dismissal would involve an *a priori* judgment about something which, being empirical, could turn out differently than expected. What it does mean is that the division between the natural and the non-natural can become hazy¹⁴.

In the 18th century, it was widely accepted that there is a distinction between primary and secondary qualities, and that only the former were really important with respect to nature. In the 19th and early 20th centuries, physicists thought that they had everything pegged with a deterministic billiard-ball model of reality. The idea of things that could be waves under some circumstances and particles under another was not part of their canon. Nor were things that had inherent uncertainties. Now we have dark matter, dark energy, DNA, and many other things that were not in the canon a century ago (or in some cases, a few years ago). Typically we assume that the canon of scientific reality is a subset of the canon of all reality, as shown in Figure 2, though the exact nature of this relationship is a matter of some dispute.

¹⁴ In fact some research has been done on brain activity of people when praying, though in these experiments “prayer” is described as either traditional prayer or any type of meditation on life, or something greater than oneself. The results of the studies are that prayer stimulates parts of the brain that help with disease fighting, longevity, empathy, and a feeling of well-being, while suppressing those parts that have negative influence on life. This work is interesting but does not capture the reality experienced by the person praying. It is another indication, however, that the Cartesian split between mind and body is incorrect. In some ways this research is similar to research on dreaming that has been done for years: it is possible to observe brain waves of people in various stages of sleep, and some characteristics of dreaming and brain activity are now known. For example, dreaming usually occurs during what is known as REM (Rapid Eye Movement) sleep. But these brain waves are not what dreams are — this is a confusion of the phenomenological (the measurable waves) and the reality (what is dreamt).

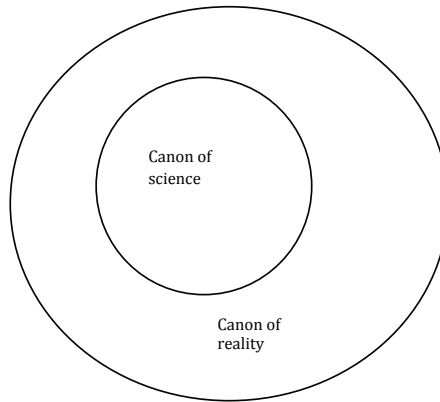


Figure 2. *The canon of scientific reality and the canon of reality overall*

The impact of the canon of scientific reality on methodological naturalism is fairly straightforward: we can only accept those things in the canon as viable components of scientific theories. This does not mean that other things, excluded from this canon, are not real, only that *they are not allowed as components of scientific theories and explanations*. Nor does this mean that the canon cannot change, as indeed it has done historically on many occasions. And it does not mean that things in the canon cannot be subjects of knowledge in other fields as well, including literature, theology, and philosophy. For example, we can discuss the universe in all three of these contexts, as well as in the context of science. Perhaps most importantly for the question of science and theology, this analysis reveals the problem with metaphysical naturalism, namely that it assumes that science itself is the ultimate arbiter of what can be accepted as real in the only meaningful sense, and what must be dismissed as an illusion, an epiphenomenon, or a myth. The problem, of course, is that the whole notion of a canon is ultimately a philosophical one, and therefore outside the realm of science.

Of great importance is the fact that the canon of scientific reality, as discussed above, is not static. Moreover, as science develops, it contributes to and modifies the canon of scientific reality, which in turn impacts the overall canon of reality. Exactly how this happens, and

how we come to accept new realities, is not well understood. Clearly for many, forced acceptance of metaphysical naturalism has overridden the more modest but more important task of understanding the nature of the canon. There is, in addition, the problem of determining how other realities such as mathematical entities, abstract entities, spiritual entities, and psychological phenomena, for example, fit into the canon. The canon has never been fixed, and may never be so, and the question of its convergence is a difficult one, equivalent to asking the difficult philosophical question of whether we will ever know everything, or how much we can know, or something similar. As Zubiri notes,

The limitation of knowledge is certainly real, but this limitation is something derived from the intrinsic and formal nature of rational intellection, from knowing as such, since it is inquiring intellection. Only because rational intellection is formally inquiring, only because of this must one always seek more and, finding what was sought, have it become the principle of the next search. Knowledge is limited by being knowledge. An exhaustive knowledge of the real would not be knowledge; it would be intellection of the real without necessity of knowledge. Knowledge is only intellection in search. Not having recognized the intrinsic and formal character of rational intellection as inquiry is what led to...subsuming all truth under the truth of affirmation [Italics added]¹⁵.

The canon of reality allows us to search for new things and new forms of reality. It is thus a guide, but of a particular and essential sort:

A canon is not a system of normative judgments but is, as the etymology of the word expresses precisely, a "metric"; it is not a judgment nor a system of judgments which regulate affirmative measurement. This "metric" is just what was previously known intellectually as

¹⁵ ZUBIRI, Xavier. *Inteligencia y razon*, Madrid: Alianza Editorial/Fundación Xavier Zubiri, 1983, p. 261-262; English edition, *Sentient Intelligence*, translation by Thomas Fowler, Washington, DC: Xavier Zubiri Foundation of North America, 1999, p. 336.

*real in its form and in its mode of reality. The thinking intellection goes off in search of the real beyond what was previously intellectually known, based upon the canon of reality already known*¹⁶.

2. SCIENTIFIC METHOD

To fully understand naturalism we must consider how science actually works—the “scientific method”. Exactly what this method is, and indeed the question of whether there is a single scientific method, are topics that have been debated now for almost a century. The “scientific method” is an analogical rather than a univocal concept, further contributing to the nebulosity of “naturalism”, though certain steps in it are common. For example, a physicist working on superconductivity or lasers can conduct direct experiments in a way that an astrophysicist working on stellar evolution or black holes cannot. Machines such as the Large Hadron Collider can expand the range of direct experiments that we can do; but direct experimentation will always be limited by time, energy, and in some cases, chronology. Nonetheless, some aspects of how science works are clear, even across disciplines as disparate as biology and physics.

The purpose of science is to investigate the natural order—natural phenomena—and explain what we have *already* observed as well as predict what we *will* observe and what we *won't*. A scientific *theory* is a set of hypotheses and definitions, together with certain rules of inference which, given some boundary conditions and empirical facts, can *explain* in a concise and compact manner a large number of already known natural phenomena. In addition, any theory should *predict* new natural phenomena, while at the same time *excluding* the possibility of others. Exclusion of some conceivable observations is extremely important, because it is this feature which guarantees that the theory will convey new information to us. A theory which can “explain” any conceivable observation does not explain anything at all—it is irrefutable, but at the price of imparting no real information.

¹⁶ ZUBIRI, Xavier. *Inteligencia y razon*, p. 57; English edition, p. 261.

In general the idea is to explain a large variety of phenomena in an economical way, as the result of a small or relatively small number of natural processes acting. The action of these processes is usually expressed in terms of scientific laws. But before we can have scientific laws, we must do observations of regularities in natural phenomena. On the basis of these regularities, the scientist can formulate explanatory hypotheses, often expressed mathematically, such as Newton's three laws. The scientist uses these hypotheses to ask questions of nature. We term these questions "experiments":

But the questions are such that the scientist has already formulated answers (predictions); he or she only wishes to know if nature will confirm these answers (predictions). Thus science has a crucial experimental component, and we often use the term "experimental science". If the predictions are confirmed experimentally, the hypothesis receives a boost and further predictions and experimental tests are performed; if not, the hypothesis is either modified or discarded, and the process is restarted.

The experiments need not refer to future events; they can refer, through predictions, to past events, events too distant in space for direct manipulation, or events on too large a scale for human action:

The key point is that investigators are told to look somewhere that they have not looked before, for something they have not seen before. It is this ongoing experimental verification and feedback that distinguishes science from philosophy and other types of knowledge.

There are five identifiable steps in the scientific method, which may be summarized as follows¹⁷:

¹⁷ FOWLER, Thomas. "Zubiri's Reality by Postulation and its Implication for the Relationship Between Science and Religion", paper presented at Metanexus conference "Continuity + Change: Perspectives on Science and Religion", June 3-7, 2006, in Philadelphia, PA, USA.

1. *Start with some knowledge of reality.* All science is based on observations which ultimately derive from apprehension, and all rational explanations are intended to tell us about reality beyond apprehension which may account for our observations.
2. *Postulate reality.* This may involve postulation of new realities such as atoms or quarks, and their characteristics stemming from their essences; or it may involve postulation of new functional relationships among things already known, such as the Universal Gas Law. There may be a combination of the two.
3. *Explore the postulated reality.* At this stage the scientist explores the new reality which has been postulated by the tools at his disposal. Typically this involves deduction or other inference of consequences about the new reality, which can be tested. As discussed above, the test does not necessarily require experiments that will directly manipulate reality, as is usually done in physics.
4. *Verify.* At this stage the scientist seeks to determine if what has been learned through the exploration of postulated reality is in accord with our experience of reality beyond apprehension. This is done by finding things in the postulated reality which have not yet been observed in reality beyond apprehension, and then searching for them in that reality, usually by experimentation. Verification in this case takes the form of congruence.
5. *Modify the canon of reality.* Successful theories remain as beyond-reality-postulations and the reality they postulate usually enlarges our canon of reality; unsuccessful theories become essentially literary postulations.

But with any attempt to give precise expression to a process of knowledge acquisition, there is inevitably a degree of uncertainty

and vagueness, because human language and human thought can never precisely express either the full nature of the process (now or what it will be in the future) or the type of knowledge to be acquired. One need only attend any scientific conference to discover that nearly all papers start with some type of disclaimer that they are approximations, that certain facts are ignored, and so forth.

Since the postulated reality is intended as an accurate description of reality beyond apprehension, it is necessary to be on guard against a serious temptation: taking the postulated reality as a complete description of reality beyond apprehension and then rejecting any evidence which contradicts it. This state of affairs occurs periodically in science—usually when philosophical or other doctrines take precedence over purely scientific considerations—and as a result all empirical evidence is interpreted as somehow verifying the postulated reality. This occurred in the case of the geocentric theory of the universe for example. Typically this state of affairs leads to great tensions and eventually to some type of paradigm shift.

When the scientist formulates an hypothesis such as “all bodies acted on by gravity fall with the same acceleration”, or “all life forms are descendants of an original life form”, the hypothesis deals with at least some phenomena that are observable today. In the first case, this is obvious: we can easily drop bodies and measure their acceleration. In the second case, we can observe today’s life forms, and at least the remains (fossils) of life forms that are extinct. We cannot observe the “original life form” or most of the intermediates, though they would have been observable had we been alive at the time. It is at this point that the crucial experimental requirement enters: we have to look somewhere we have not looked, for something we have not seen before. So even in the case of sciences dealing with past events, there are experimental implications. That is, the hypothesis should tell us to examine something, say DNA, that is observable today, and we should see something there that we had not observed before. Or we should look for something in the fossil record (which is observable) for some pattern that we had not observed

before. One reason we may not have observed the phenomenon before is that the reality postulated by the new hypothesis was not part of our canon of reality before.

In many cases such as those mentioned earlier, such as the problem of prayer and healing, not merely the canon of reality but the nature of the scientific method itself is less than clear. Obviously, language cannot explicitly formulate the scientific method, because the method is always changing and evolving and it is simply not capable of being put into a strict algorithmic form. This haziness surrounding the scientific method accrues to naturalism as well.

Moreover the boundary between science and philosophy can be difficult to discern. As two engineering professors from Oxford have noted,

The advent of quantum mechanics brought problems to the physicist which previously belonged to the sacred domain of philosophy. The engineer can still afford to ignore the philosophical implications but by a narrow margin only¹⁸.

A perusal of the literature dealing with interpretation of quantum mechanics, dark matter, black holes, the big bang, string theory, or many other areas of current interest in physics will quickly reveal just how blurry the boundary can be.

SUMMARY OF THE NATURE OF SCIENCE

Science is naturalistic, and naturalism involves two components: a canon of reality (what is acceptable for use in scientific explanations) and a particular method, the scientific method. Because both of these are ultimately hazy, and subject to change, the boundary between the naturalistic and non-naturalistic is likewise not hard-and-fast. It is clear that science reveals to us aspects of reality of which we would otherwise be unaware, and we accept these things now as part of the canon of reality in the fullest sense. Examples are genes,

¹⁸ SOLYMAR, L. – WALSH, D. *Lectures on the Electrical Properties of Materials*, Oxford: Clarendon Press, 1970, p. 57.

dark matter, dark energy, the weak and strong nuclear forces, tectonic plates, black holes, and quasars, just to name a few. Science thus adds naturalistic entities to the canon of scientific reality and thus to the canon of reality in general. Statements about reality are metaphysical; how does this philosophical position square with the fact that science is now the main thing that tells us about new realities? Independently of science, things have aspects of reality such as truth and beauty (transcendentals); and reality itself has characteristics, such as its field nature, which are not naturalistic in the sense of being investigable by science.

The belief that science could be defined by naturalism assumed that the canon of scientific reality could be fixed, and the scientific method could be clearly and unambiguously defined. Continuing developments in science can change canon of reality and affect philosophical theories, as happened with the development of quantum theory. The canon is driven by philosophical assumptions. The failure of reductionism means that elimination of non-naturalistic notions (reality) cannot be accomplished.

Secondly, real things have aspects that are not capturable or even definable by science. These include transcendentals such as truth, beauty, etc. This does not really affect methodological naturalism, but is fatal for metaphysical naturalism, because it shows that the canon of reality is much larger than the canon of scientific reality.

The best that we can do, and what scientists do in practice, is to choose a particular canon (which may be different for the psychologist than for the physicist), agree on the details of what is an acceptable scientific method, and then see how far they can get. It is fairly straightforward to include some things, such as elementary particles (for the physicist), or atoms (for the chemist or biologist), and to exclude some things (such as God) from the canon. Within limited areas of human experience, the results may be quite satisfactory. For example, Newtonian mechanics works quite well in many applications, and did so long before the advent of Relativity

or quantum mechanics, and it continues to be extremely useful. The results of this process may lead to revisions in the canon of scientific reality and hence in that of the canon of reality in general. But it cannot displace or replace the canon of reality in general, nor can it guarantee that we have found the final, definitive canon.

THE EIGHT WAYS IN WHICH SCIENCE AND THEOLOGY DIFFER

We shall now turn to the seven ways in which science and theology differ. These ways are not entirely independent, but may be discussed separately for pedagogical purposes.

1. The *object* of their knowledge.

In a trivial sense, of course, theology is concerned with God, whereas science is concerned with the natural world, the “naturalistic”. This is true but does not really explain the difference in object, simply because God and the natural world are not totally independent.

In effect, we are told that the natural and the supernatural form a partition of all...of all what? Of phenomena, of statements, or of reality? For now let us consider the former. We have the following diagram (see Figure 3):

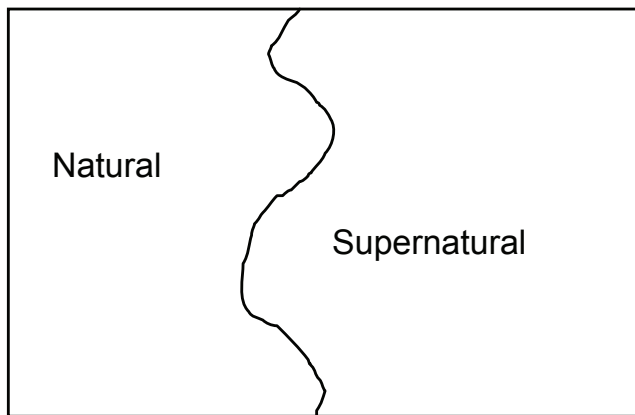


Figure 3. Division of Phenomena into Natural and Supernatural

But what is the nature of that dividing line? In some cases the distinction is clear. For example, God would be securely placed on the supernatural side. And the case of the moon's orbit around the earth is clearly on the natural side. But is there such a thing as the transcendental? If so, is it natural or supernatural? If not, why is it such a part of human thought? What about truth, justice, and beauty? From chaos and fractal theory, we have become accustomed, in recent years, to recognizing that dividing lines formerly thought to be quite sharp can be infinitely complex. Or they can involve gradations, as in Figure 4.

A similar problem exists with respect to the division between "naturalistic" and "non-naturalistic" (statements, arguments, explanations, etc.). We do not know the nature of the dividing line. Is a hard and fast division possible? Problems begin with human perception, the ultimate basis for any empirical science. Are colors as perceived naturalistic? What about sounds? The matter is especially interesting because virtually no one who discusses science, including Creationists, claims that we have access to anything other than sense data. Yet most have concluded that we can have knowledge of something beyond what sense data delivers, and indeed that such knowledge is necessary to understand the world. Transcendental knowledge, for example: knowledge of truth, beauty, etc., comes from our ordinary knowledge. Anyone who has stood before a great painting and been moved deeply, or who has had a similar experience when listening to great music or hearing great literature, knows that this experience of the transcendental is very real. Many other experiences of daily life have the same import: experiencing the beauty of nature, deep friendships, or even contemplating the mysteries of nature that the scientist seeks to understand. For example, some scientists (such as Robert Jastrow) turn to religion from the study of astronomy.

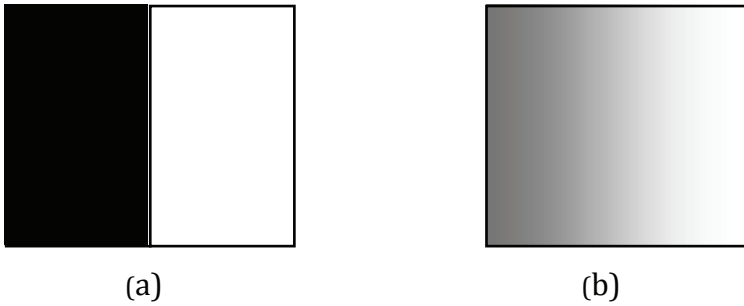


Figure 4. The two views of science and philosophical/theological knowledge.
 (a) hard-and-fast distinction. (b) gradual progression

Zubiri expresses the transcendental in an interesting manner:

There are things we do not perceive directly, not because they are ultra, beyond the things we encounter directly, but precisely the opposite, because they are something that is in every perception and in each thing. We do not perceive them precisely because they are constitutively inscribed in the obvious; we do not perceive them... because they lack that minimum opacity necessary for human beings to encounter them. That lack of opacity is what the term diaphanous expresses...the diaphanous is transcendental. It is transcendental, not in the sense that is something very important, but in the sense that it transcends in one form or another those things that are obvious, without however being outside of the obvious things¹⁹.

This suggests that even things believed to be securely in the naturalistic camp have aspects that go beyond what science can investigate. Does that make them somehow non-naturalistic, or does it point to the need for a broader view of reality than metaphysical naturalism conceives? Those who maintain the existence of

¹⁹ ZUBIRI, Xavier. *Los problemas fundamentales de la metafísica occidental*, Madrid: Alianza Editorial/Fundación Xavier Zubiri, 1994, p. 19. English edition, *The Fundamental Problems of Western Metaphysics*, translated by Joaquín Redondo and Thomas Fowler, Lanham, Maryland: University Press of America, 2010, p. 12.

the supernatural do not claim that we have some sort of sixth “supernatural sense” that allows us to perceive the supernatural. Rather, they maintain that the supernatural can be perceived through the five senses. As St. Paul famously remarked, “For since the creation of the world His invisible attributes, His eternal power and divine nature, have been clearly seen, being understood through what has been made...”²⁰. Moreover, as discussed above, the concept of the transcendental, in philosophy, has historically referred to the fact that we perceive things (e.g., beauty, truth, being) that are not immediate sense perceptions.

The correct distinction is that science is concerned with the naturalistic, as discussed and defined above; but the naturalistic is not entirely separate from the supernatural. Rather, the supernatural—the object of theology—concerns both things obviously supernatural such as God, angels, etc., *and* the natural in certain of its imprecindable aspects, in particular, their transcendental aspects. Furthermore the boundary between the natural and the supernatural cannot be made hard and fast, and thus there are aspects of reality which science cannot explain because the relevant questions cannot be meaningfully formed in purely scientific terms. For this reason the canon of scientific reality will always be somewhat hazy.

2. MANNERS OF INVESTIGATION

As discussed above, science relies on a particular method, and utilizes a particular canon of reality. Science thus *asks questions of nature at the direct observational level*, utilizing a particular methodology designed to give answers at this level. It looks for functional relationships among directly observable quantities, functional relationships that can be expressed in unambiguous language, especially mathematical language. The questions it asks must be formulated in a particular way, with answers likewise expected in a certain form with a certain set of things acceptable—

²⁰ Romans 1:20, *New American Standard Bible* translation.

forces, masses, and so forth, namely the canon of scientific reality. It gets its answers through experiments, which can compel changes in the set of functional relationships assumed in any given theory.

Theology is not an experimental science of this type: it does not ask questions of nature and then perform experiments to find the answers. God did not tell Moses, "Try these Ten Commandments out and see if they work." Nor is there a "theological method" corresponding to the scientific method, or a particular "canon of theological reality". Rather, theology conducts investigation by rational inquiry, along similar lines to philosophy (whose results it often accepts); but it relies on other sources than just humanly achievable knowledge, sources such as Scripture, tradition, and the actions of people, such as martyrs. Some of these sources give absolute, not conditional knowledge, e.g., God created the world, and Jesus died for our sins and was resurrected. However this knowledge still needs to be applied in each generation, and that application may require that theological truths be interpreted for the particular circumstances. A case in point today is biomedical ethics, where questions of life support made possible by technological advances could not have been posed in earlier times. Theological reasoning can also become enmeshed with the state of knowledge or speculation at any given period, and draw incorrect inferences from its sources based on that knowledge. This of course happened with respect to the geocentric theory of the solar system. The geocentric view, inherited from the Ancient Greeks, became fully integrated into theology, leading to a great crisis in the 16th century.

So theology uses reason in conjunction with known facts about the world, scientific knowledge, revealed truths, tradition (including the writings of saints and other revered figures), and faith, to pronounce about moral and ethical matters. Reason in this context may include inquiry, reflection, reasoning by deduction, induction, analogy and other methods, contemplation, and prayer. Theological reality encompasses all the real, not just the canon of scientific reality,

naturally. The matters over which theology can range run from individual problems to problems of society as a whole, including the question of the justice of laws and even governments. It does not extend to scientific questions *per se*, though it can deal with inferences from scientific results—which are often improperly claimed to be science itself.

3. LEVELS OF KNOWLEDGE

Typically, those who reject other forms of knowledge in favor of science exclusively have have a straightforward view of science: *science is objective knowledge about the world*. Advocates of this view also claim that truth is an agreement of thought with things. Now, Zubiri would agree that science is objective knowledge about the world; where he disagrees concerns the level of the knowledge delivered by science. For those who accept (implicitly or otherwise) the logification of knowing, there is only the one level, that of rational knowledge. In Zubiri's philosophy, this is not so, as discussed above; science is *not* the primary source of knowledge. There are three levels of knowledge: primordial apprehension of reality (direct contact with reality), logos (defining what things are with respect to other things), and reason (methodological explanation of what things are and why they are, as in done in science, literature, and theology, for example). So science, a form of reason, must build on what *is* the primary source, primordial apprehension. Moreover, since the truth attained by reason is not what he terms "real truth", i.e., absolute truth, it is not infallible—further developments can force revisions. This allows Zubiri to overcome one of the major objections to realism as a theory of science: the history of science is replete with examples of new theories replacing old ones because of new discoveries and new evidence. Under any realist philosophy in which rational knowledge is the "gold standard" of knowledge, this is a conundrum: how can "knowledge" be overthrown? How can replaceable scientific theories give us certain knowledge? But for Zubiri, scientific theories are not our primary source of knowledge

of the world; so their replacement as science progresses does not pose an epistemological problem, as it does for the advocates of any philosophy of science making it (science) the primary access to reality.

In some cases, advocates of science as the source of all knowledge assume a more positivistic attitude: the meaning of a statement is intimately related to its operational method of verification, so scientific knowledge is the only knowledge available, since non-scientific statements cannot be so verified. This leads to a leveling of knowledge:

...science begins by breaking down [the] world so as to reduce it to its just cognitive proportions. These just proportions are expressed in the term "the facts:" what is before me, only in virtue of being there and insofar as it is there, without the least intervention on my part. Now, the facts thus understood tend to be reduced to empirical data. Scientific truth will consist in nothing but agreement with these data, and science will be simply a knowledge about their ordered concatenation. The reduction of things to facts, and of facts to sensible data, leads inexorably to the idea of an intellectual life in which all branches of knowledge are equivalent and whose overall unity is given only in the encyclopedia of complete knowledge²¹.

For Zubiri, there are three serious problems with any positivistic approach such as this: (1) The meaning of statements cannot be identified with their method of verification, because this represents a hopeless confusion of the three levels of human intelligence. Verification methods involve concepts of reason, whereas the meaning of statements arises at the level of logos, coupled of course with primordial apprehension of reality²². (2) We are not dispossessed of knowledge of things, but have it through

²¹ ZUBIRI, Xavier. *Naturaleza, Historia, Dios*, p. 16; English edition, p. 17.

²² Of course, the meaning of some statements may involve reason, but ultimately meaning has its roots at the level of logos.

primordial apprehension (though not in the scientific sense, of course). (3) There is no one-to-one mapping of facts to sense data, because this again represents a confusion of levels of human intelligence. The senses do not deliver “data” to us because they do not “deliver” anything at all: that is the paradigm of *sensible intelligence*, based on a presumed separation of sensing and knowing. We do not have to infer reality based on data delivered to us, on the model of an information technology system with remote sensors, because we are immersed in it; the sensing and knowing are part of a single, integral process: *sentient intelligence*.

Moreover, reality, in Zubiri’s philosophy, cannot be entified, and thus broken down into logical atoms, be they sense data or billiard-ball particles. As discussed above, reality is something open. Reality cannot be considered as some transcendental *concept*, or even as a concept which is somehow realized in all real things:

...rather, it is a *real and physical moment*, i.e., transcendentality is just the openness of the real *qua* real....The world is open not only because we do not know what things there are or can be in it; it is open above all because no thing, however precise and detailed its constitution, is reality itself as such²³.

So the idea of being able to capture it in a complete way, or to say all that can be said about it utilizing rational knowledge such as science, is doomed from the start. There will always be knowledge about the world which cannot be subsumed under science (or any other form of rational knowledge), or captured in any human formula. Zubiri notes that art, literature, and music are other examples of rational knowledge that tell us about the world—and tell us different things about it than science does. Hence, the fundamental or constitutive openness of reality means that the quest for it is never-ending; he believes that the development of quantum mechanics in

²³ ZUBIRI, Xavier. *Inteligencia y razón*, p. 20; English edition, p. 248.

the twentieth century has been an example of how our concept of reality has broadened.

Any philosophy must, before all else, come to grips with and be compatible with our most basic experience. And for Zubiri that experience is not of ideas, or concepts, but of *reality* itself: the world, other men, trees, and the like. As he puts it:

...there is something which is antecedent to exercise of the intellectual function: things themselves must be 'putbefore' the understanding; that is, things have to be present to man. We leave aside any subsequent complications. Whatever may be the means and ways by which man can have things present, they have to be there. Otherwise it would be impossible to even begin to understand....And to this patency of things the name 'truth' can be given in the most fundamental sense²⁴.

Before leaving this topic we must investigate one further but closely related aspect of it, and that is the philosophical interpretations often erected on top of scientific theories. It is, in fact, these interpretations that are usually the source of friction between science and theology. Each such philosophical interpretation is built on a complex foundation that includes a particular scientific theory, a worldview, and a set of philosophical (and possibly theological) assumptions, as illustrated in Figure 5. The philosophical/theological assumptions are the deepest metaphysical and epistemological assumptions about the nature of reality and the means of knowing. The scientific theory, of course, is the particular theory chosen as the best explanation of observed facts. The "worldview" is the overall view of reality and how it works that forms the basis for most judgments by the person. And finally, the philosophical or theological interpretation is what puts the science in the context of human knowledge and man's position in the universe. Of course, there is some interaction between the worldview and the scientific theory, as well as between

²⁴ ZUBIRI, Xavier. *Naturaleza, Historia, Dios*, p. 13; English edition, p. 14.

the scientific theory and the philosophical assumptions. But the main drivers are in the sense indicated.

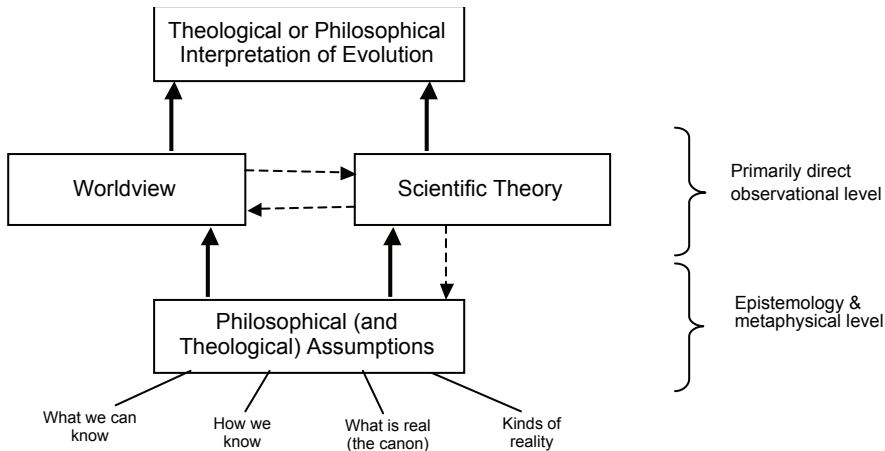


Figure 5. Underlying commitments for philosophical interpretations of science

These underlying commitments themselves involve fairly distinct elements or levels: (1) the direct observational level, (2) what may be termed the “metaphysical level” and (3) the “epistemological level”. The *direct observational level* concerns the directly observable facts about nature, and the various theories advanced to explain them. This is the level of most day-to-day experience, and also the level at which empirical science operates. Worldviews also operate at this level. Much of the Bible’s narrative also appears at this level—the historical books, the gospels, and the Acts of the Apostles, for example. But much of what is *said* in those books deals with matters that are not at the direct observational level.

With respect to philosophical and theological assumptions, in Figure 5, there are two components: the *epistemological level* concerns questions of the scope of science and scientific knowledge, how we know in science, and how certain that knowledge is (or can be). As noted above, certain questions cannot be meaningfully formulated

in scientific language; this is a reflection of the fact that knowledge exists on multiple levels.

The *metaphysical level* deals with questions about the nature of reality (what is real) and the degree to which our experience at the direct observational level tells us about reality, especially reality beyond that experience. One question of great interest is the potency of matter as created, and specifically, whether matter was created with the ability or potency to engender life, so that life is just as natural a phenomenon as gravity, for example. In that case, evolutionary processes are an expression of Divine will, as in Genesis 1, "Then God said, '*Let the land produce vegetation: seed-bearing plants and trees on the land that bear fruit with seed in it, according to their various kinds.*'" Other metaphysical questions directly related to the interpretation of evolution include creation *ex nihilo* vs. creation from existing matter (often confused), and *creatio continuo*, continuous creation, i.e., the need for God to sustain things in existence. Questions about the meaning of events, the nature of morality and ethics, the significance of transcendentals such as beauty and truth also have their locus here.

The situation is analogous to that of two aircraft flying in proximity to each other. From the ground, looking straight up, the planes appear to be on a certain collision course. But if one takes a three-dimensional view—that is, sees the situation from a broader, more comprehensive perspective—there is no danger because the planes occupy different places in the sky, just as theological beliefs and scientific theories occupy different levels in the hierarchy of knowledge in any theistic interpretation of evolution, for example.

However, it should not be assumed that just because knowledge occurs at multiple levels, contradictions between theological and scientific knowledge can always be avoided. This remains a potentially a very serious problem for any interpretation of scientific theories that does not completely disconnect the world of ordinary experience from theology. To take a simple example, the resurrection of Jesus is something

that occurred (or did not occur) in a particular time, at a particular place, i.e., on the direct observational level. It is simultaneously an empirical and a theological fact (for Christians). Likewise the miracles associated with Moses and the Pharaoh, the crossing of the Red Sea, Joshua and Jericho, etc., are both empirical and theological facts. Considered just as facts at the direct observational level, they would be incompatible with a strictly materialistic interpretation of science and knowledge, since miracles or other direct divine intervention make no sense under that interpretation. On the other hand, if these things really happened, they would instantly refute the entire worldview and philosophical underpinning of any atheistic school—and proponents of such schools are acutely aware of this fact. Such potentially explosive issues are what make the relationship of science and theology so intriguing: factual issues that deal with observable events have the capability of annihilating not just an interpretation, but a whole worldview and its underlying philosophy (and perhaps theology).

At the deeper levels, the metaphysical and epistemological, the situation is quite different, because the claims made are *not* subject to direct experimental test. For example, one cannot directly test an assertion such as “Only material bodies are real” or “There are no abstract entities”. Metaphysical claims in general are very problematic with respect to direct verification. For example, if I say that dreams are only physico-chemical processes, I have made a metaphysical claim about the reality of dreams, but not one which can be verified in any easy manner, if at all. In fact, one can argue that I have made a very confused and bizarre claim that mixes aspects of completely different levels of reality. Claims about parallel universes, and even some aspects of string theory, fall into the same category^{25/26}. One can combine assumptions at the philosophical level with scientific theories in order to make inferences—extrapolations actually—about

²⁵ WOIT, Peter. *Not Even Wrong: The Failure of String Theory And the Search for Unity in Physical Law*, New York: Basic Books, 2006.

²⁶ SMOLIN, Lee. *The Trouble with Physics, The Rise of String Theory, the Fall of a Science, and What Comes Next*, Houghton-Mifflin, 2006.

what is real. Worldviews often arise in this manner, and are staunchly defended as if they are based entirely on science. Often such mixes lead to very confused positions, such as the belief that events such as the Big Bang correspond to *creation ex nihilo*, or that science can “disprove” religion (or philosophy).

4. LEVELS OF REALITY

A key difference between theology and science is that theology (and philosophy) recognize that *reality exists at several levels*. Thus the same physical event can have meaning at the physical level, and also have meaning at several meta-levels. It is over this point that most criticism of philosophical and theological knowledge stumbles. For example, if someone falls into a river and drowns, this is a physical event and can be analyzed by determining the height of the fall, the speed of impact, the absence of oxygen, and so forth. But it can also be understood with respect to morality: was the person pushed (i.e., murdered)? Did he jump (i.e., suicide)? At another level, was it a symbolic act, perhaps an act of defiance in a political context? In a more directly theological context, take the Eucharist: it is a physical act of saying words and making motions over certain physical substances, namely bread and wine; it is also an act that transforms, at another level, the substance of the bread and wine; at still another level it also is an act of salvation for the Christian faithful, who consume the bread and wine. Only the first of these acts has any meaning for the scientist.

How do these levels, and the assumptions made at each level, affect the philosophical and theological interpretations of evolution? To answer this, we must make a slight digression and discuss two philosophical doctrines that affect the question of science and theology, namely reductionism and nominalism. Together with metaphysical naturalism, discussed in the previous section, they form what may be termed the “unholy trinity”²⁷. Reductionism, in its most

²⁷ FOWLER, Thomas. “Reductionism, Naturalism, and Nominalism: the ‘Unholy Trinity’ and its Explanation in Zubiri’s Philosophy”, *Xavier Zubiri Review*, Vol. 9, pp. 69-88 (2007).

radical form, is the theory (or belief) that all scientific knowledge can ultimately be reduced to basic physics. Thus, biology reduces to chemistry, and chemistry to physics of atoms of molecules, and these to particle physics...and this reduction includes human consciousness. Nominalism is the theory (or belief) that only concrete things exist; abstract entities such as species do not.

Nominalistic definitions of concepts such as "species" are often deemed essential to evolutionary biology²⁸. Though appealing (to some) at first glance, nominalism quickly leads to nasty problems, such as the fact the most ordinary discourse either becomes meaningless or means something quite different than what the speaker intends. A statement such as "Beethoven's Ninth is a great symphony" has abstract entities for both its subject (concretely there are only performances of the symphony) and its predicate, "symphony". Mathematics lives and breathes abstract entities. Though fascinating, a general discussion of nominalism is beyond the scope of this work.

In this connection we need to discuss briefly the famous Cartesian dichotomy of *res cogitans* and *res extensa*, which has become such a deep-seated part of Western thought. Is this distinction viable or useful for understanding nature and our relationship with it? Descartes' idea has become, in many ways, a proxy for spiritual vs. material in our world. Undoubtedly it has roots in spiritual writing; and many biblical passages can be interpreted to support a dualistic view of reality. Nonetheless Zubiri believes that it is fundamentally flawed, as revealed by our very knowledge of God:

God is not a personal reality beyond things, but is personally present in them, formally constituting their reality. Because of this He is constitutively accessible in real things themselves. Never, not even in the most sublime access of the great mystics, is God accessed without things or outside of them. Real things are the personal presence of God. And precisely because of

²⁸MACBETH, Norman. *Darwin Retried: An Appeal to Reason*, Harvard: Harvard Common Press, 1971, p. 22-24.

*this, He is constitutively accessible. God is accessible in and through the world*²⁹.

To what extent has this notion of absolute separation affected our view of science and religion as inhabiting different realms and dealing with different realities? Too much, undoubtedly.

Is science by itself capable of delivering reality to us? No; and the proof is in our most basic experience:

*To physics, freedom, for example, has no meaning; not because it isn't real, but because its reality has no physical meaning, or as it were the meaning which physics gives to the word 'reality' leaves the fact of freedom outside of the world. But this, of course, does not prevent freedom from being a fact nonetheless, i.e. a reality, though in a different sense than that which physics assigns. The idea of reality acquires its meaning through the 'all' in which each real thing is inscribed*³⁰.

And what is more, physics after quantum mechanics no longer has the meaning of investigation of absolute space and time, of reality in an ultimate sense, the sense which gave rise to the so-called scientific proofs of the existence of God, based on such things as Fermat's principle of least time, or the second law of thermodynamics. Our predilection to identify nature with reality is accordingly the result of a deeply flawed vision of what nature is. Indeed, in a famous and very perceptive comment, Zubiri wrote, "Physics, even more than in the case of Einstein, has nothing more than a human meaning. Strictly speaking, for God not only is there no physics, there is no *nature* in this sense, either"³¹.

²⁹ ZUBIRI, Xavier. *El hombre y Dios*, Madrid: Alianza Editorial/Sociedad de Estudios y Publicaciones, 1984, p. 185-186; English edition, *Man and God*, translated by Joaquin Redondo, Thomas Fowler, and Nelson Orringer, Lanham, Maryland: University Press of America, 2009, p. 140.

³⁰ ZUBIRI, Xavier. *Naturaleza, Historia, Dios*, p. 89; English edition, p. 82.

³¹ *Ibid.*, p. 302; English edition, p. 265.

5. LEVELS OF MEANING

This difference centers on the fact that theological statements, even if they are descriptions in a sense of something that occurs on the direct observational level, can have multiple meanings. Consider the following example: If we have a kettle of water boiling on a stove, we can ask, "Why is the water boiling?" The question can be answered at several levels:

1. It is boiling because of the heat transfer from the fire to the water via the metal forming the bottom of the kettle. This heat transfer takes place due to molecular movement.
2. It is boiling because I put the kettle of water on the stove and turned the stove on.
3. It is boiling because I want to drink a cup of tea.
4. It is boiling because I need to drink a cup of tea to fulfill a Divine mandate.

Those who accept the unholy trinity argue that all of the latter two explanations are not really important because they too can be reduced to atomic or molecular processes in the brain and body, leading to the indicated behavior, whether physical or verbal. Those who advocate theistic evolution, such as Haught, respond that the statements cannot be reduced to quantum physics because questions involving human intentionality cannot be meaningfully expressed in that language. Moreover, such reductions are never actually carried out, and barely sketched as a project. Open to debate is the epistemological problem of whether it is possible to define truth and knowledge in a consistent fashion under the philosophical assumptions of the unholy trinity:

...there is a blatant contradiction between an exclusively selectionist explanation of mind, on the one hand, and the implicit trust you place in your own mind's capacity to arrive at the naked truth, on the other. Clearly, in asking me to accept the truth of evolutionary materialism's selectionist explanation

*of human intelligence, you have tacitly introduced something extraneous to your pure Darwinism*³².

This leads directly to the question of what philosophical assumptions the conduct of science actually requires. That problem is well beyond the scope of this paper, but some discussion of it in the context of the unholy trinity can be found in the references³³.

Levels of meaning appears again when we consider the ways in which science and theology talk about reality. Science deals with reality on the direct observational level, "what you see is what you get"; it does not look for any "meaning" beyond directly observable phenomena. Theology, on the other hand, takes phenomena at the direct observational level and uses them as a way to convey other, deeper meanings, usually through symbolism or metaphor. Consider a typical New Testament parable, such as the prodigal son, told in Luke 15:11-32. At the phenomenological level, the story is about a young man who takes half of his father's money and goes off, squandering it on loose living. Then he becomes hungry and returns home, hoping to find work as a servant. His father is overjoyed and welcomes him back, but his brother is upset and refuses to join the celebration. Such a situation could easily be observed—there is nothing mysterious about it. In fact, this kind of thing probably happens on a regular basis. The purpose of the parable, though, is to teach a theological lesson (or perhaps multiple lessons). It is about love and forgiveness, about recognition of one's sins, and metaphorically about Jesus' coming: the celebration is Jesus arrival and the coming of the kingdom; the angry brother represents the Jewish leaders (mainly the Pharisees) of the time who refused to join the celebration, angry because they believed they had always served and were not appropriately rewarded. There can be other interpretations. But not one of them can be understood at the phenomenological or direct observational level. The same is true of other parables and much of the language

³² HAUGHT, John. *Deeper than Darwin*, Boulder, CO: Westview Press, 2003, p. 98.

³³ FOWLER, Thomas. "Reductionism, Naturalism, and Nominalism".

of the Bible. Theology talks about reality at a level that goes beyond what science can consider.

Let us consider an example of how the levels of meaning differ. The reader can visit any major natural history museum, such as the Smithsonian National Museum of Natural History in Washington, and see a display of skeletons from simple mammals through chimps and apes up to man. The similarities are quite remarkable. For the biologist, this similarity suggests a common origin—common descent from a primitive ancestor. That is the explanation (or an explanation) at the direct observation level. With respect to theology, the same sequence can elicit a different explanation, which does not contradict the biologist's explanation but operates at a higher level. The sequence can be an example of God's goodness in providing creatures with a skeleton suited to their environment, or an example of a common design plan. With respect to cosmology, similar conclusions can be drawn. The vastness of the universe, while observable with modern instruments, can be understood with the tools of physics. But it can also be understood by the theologian as an expression or analogue of the unfathomable power and majesty of the Creator—an explanation that does not in any way conflict with physical explanation.

6. GOALS OF SCIENCE AND THEOLOGY

Science seeks to understand and explain the occurrence of natural phenomena. Such explanations are in terms of what Zubiri calls "functional" relationships—his modern replacement for the old causal laws, which were excessively restrictive. (In Zubiri's view, causality is really functionality; most scientific laws do not fit the paradigm of causality in the traditional sense). In classical philosophy, causality expressed a particular type of relationship between two things (or events, or processes). Such relationships, with the characteristics described above (determinism, uniformity, real production, etc.), were assumed to be the only ones possible, at least in the sense that all others ultimately reduce to them. As such,

they formed the basis for knowledge in classical philosophy, and did so even through the time of Kant. For some schools of thought, such as the Scholastic and neo-Scholastic, they still do³⁴. But we now know that things can be related in many more ways than can be adequately described by the deterministic paradigm of classical causality.

To describe this situation, Zubiri has borrowed an idea, and related terminology, from mathematics: that of *function*. In mathematics, a function describes a relationship among variables. There may be more than two variables involved, and a given variable may be a function of several or even hundreds of other variables. The function itself describes how one or more variables (the dependent variables) change when other variables (the independent variables) change. This is a much more general way of describing relationships among things, especially since the relationships may only be adequately expressible in mathematical language. They may, for example, involve statistical ideas. Functional relations may or may not involve causality in the traditional sense, or Hume's version, constant conjunction—both of which are special cases of it. Functionality is a much broader concept, capable of supporting inferences such as counterfactual conditionals which are beyond the range of constant conjunction. Zubiri notes: "...functionality... is dependence in the broadest sense of the word. This functional dependence can assume diverse forms....Succession, coexistence, position, spaciocity and spatiality are types of functionality"³⁵.

To clarify the distinction between functionality and causality, especially causality in the classical sense, Zubiri points out that functionality does not require the notion of the real influence of cause on effect:

From my point of view, causality is the functionality of the real qua real. Taken in its fullness, this concept of functionality is liberated from the idea of "influence",

³⁴ MARITAIN, Jacques. *An Introduction to Philosophy*, tr. by E. I. Watkin, New York: Sheed and Ward, 1962, p. 64.

³⁵ ZUBIRI, Xavier. *Inteligencia y logos*, (Second volume of trilogy, *Inteligencia sentiente*), Madrid: Alianza Editorial/Fundación Xavier Zubiri, 1982, p. 37; English edition, *Sentient Intelligence*, p. 118.

and most importantly, leaves open the type of causality which may intervene in each case. The reality itself of the real, as its own physical moment, is founded on the absolutely absolute reality; therefore, a functionality of reality itself with respect to God exists³⁶ [Italics added].

Functionality eschews the dependence of causality on entities or things, and recognizes that it is more general characteristic.

Functionality is given in the impression of reality, in primordial apprehension; indeed, it is a formal moment of that impression³⁷. There is no inferential process required at that level (though this is not the case at the level of logos and reason). How is it given? Zubiri's radical rethinking of intellection supplies the answer: "...functionality is formally sensed, i.e., not only is it something accessible, it is something for which access is already physically given in sentient intellection, in the transcendental 'toward'"³⁸.

Causality is functionality of the real *qua* real, but recall that "reality" does not mean the same thing—a zone of things—as in all earlier philosophy. It is, rather, a formality, something *in its own right*. In this new and more general vision, traditional causality becomes merely a possible type of relation between things. It is something more than just determinism, but less than the most general way of describing those relations. We perceive traditional causality only in the case of our own actions.

So science is concerned with establishment of functional relations among publicly observable phenomena, not causal relations in any metaphysical sense, and theoretical explanatory frameworks built upon these functional relations. Philosophy then has the role of understanding reality at all levels, and correspondingly, understanding how human knowing unfolds. Philosophy has a basis in man's basic contact with reality, primordial apprehension, and its certainty stems from this contact. But philosophy makes use of the broad range of knowledge that human

³⁶ ZUBIRI, Xavier., *El hombre y Dios*, Madrid: Alianza Editorial/Sociedad de Estudios y Publicaciones, 1984, p. 152; English edition, p. 116.

³⁷ Id., *Inteligencia y logos*, p. 39; English edition, p. 118.

³⁸ Ibid., p. 40; English edition, p. 119.

knowing at higher levels, especially reason, achieves, and thus gives us our overall vision of reality. Sometimes Zubiri's views on this relationship are expressed in terms of transcendentality. Intellective actualization of a thing in primordial apprehension gives us the thing as "such and such", its particular reality, as well as giving us the thing as a reality *simpliciter*, because each thing is more than just its particular characteristics. The "such-and-such" actuality of things—knowing about it and explaining it—is regarded as the task of science, whereas understanding the transcendental actuality of things, what makes them more than just a set of particular characteristics, is the task of philosophy³⁹.

Zubiri frequently explains this difference in terms of the notions *cosmos* and *world*. We have already had occasion to remark on the difference between the phenomena of science and the things of the world; but this distinction is ultimately only part of a much larger and more profound one, that between *cosmos* (as ordered totality of *things*) and *world* (as comprehensive scheme of phenomena). Knowledge about the cosmos, which means knowledge of the things constituting it—men, plants, the sea, etc.—is the object of Greek *episteme physica*; whereas knowledge of the regular appearances of phenomena is the goal of modern science. This general position becomes clearer when we consider the attitude taken by the Greek *visavis* that taken by contemporary man in his experimental science:

*Face to face with phenomena, the Greek immediately directed his attention to the things which appeared. He did not know how to extract what is called 'world' from this subtle structure which he possessed, the world which man has and in which he exists. Science has determined that the passing of phenomena obeys laws and not just causes, i.e. that phenomena constitute a world characterized by its own proper structure, a world which consists in its own occurrence or happening.*⁴⁰

³⁹ GRACIA, Diego. "Ciencia y filosofía", *The Xavier Zubiri Review*, Vol. 7 (2005), p. 25.

⁴⁰ ZUBIRI, Xavier. *Nature, History, God*, p. 88; English edition, p. 81.

It is not true, of course, that the Greek failed to recognize that what we have termed 'world' exists; rather, it held little interest for him, and he preferentially directed his attention to the *things* of the world. If he was interested in structures, it was the structures of things, not of phenomena. Science, on the other hand, bases itself on the idea that phenomena constitute a world. But the Greek did not regard the universe as a chaotic conjunction of entities or things; recall Aristotle's *taxis* of the physical world which culminates in the *Theos*. Rather, through the four causes, the movement of all things in the universe was to be explained, ultimately with reference to the *Theos*. Science, on the other hand, restricts its attention to the world and the phenomena occurring therein⁴¹.

It must always be recognized that the highly polemical nature of the evolution controversy, and the extra-scientific stakes, dim the prospects for agreement in the foreseeable future. As Francis Bacon noted long ago:

The human understanding when it has once adopted an opinion (either as being the received opinion or as being agreeable to itself) draws all things else to support and agree with it. And though there be a greater number and weight of instances to be found on the other side, yet these it either neglects and despises, or else by some distinction sets aside and rejects; in order that by this great and pernicious predetermination the authority of its former conclusions may remain inviolate⁴².

7. SOURCE OF KNOWLEDGE AND AUTHORITY

Science is an empirical discipline, as we have discussed. Its goal is to understand nature at the direct observational level. The work of many centuries has produced a great volume of knowledge that *works*—scientists can make predictions about many things (e.g.

⁴¹ ZUBIRI, Xavier. *Nature, History, God*, p. 88; English edition, p. 81.

⁴² BACON, Francis. *Novum Organon* (1620), Book 1, Aphorism 46.

eclipses, chemical reactions, genetics) that are accurate, and much of our modern society runs on devices and technologies built by engineers who use the results of scientific inquiry. This ultimately is the source of its authority, as opposed to the pronouncements of quacks and pretenders to knowledge, whose ideas rarely lead to useful results. If science did not lead to verified predictions, and useful products, its authority would be greatly diminished. This is not to say that the *goal* of most scientists is to produce something useful; for most, their goal is to understand nature. But by correctly understanding nature, through the process described earlier, they do produce useful results. Were there no useful results or verifiable predictions about nature, science would be little more than idle speculation.

Theology (in the Christian tradition) has its authority from scripture and the Magisterium. This is ultimately the reason people are interested in what theologians have to say about spiritual and ethical matters, and about the justice of various political and economic issues. Faith itself is results-oriented in several ways, not the least of which is its role as a sign of contradiction: it encourages people to do things that, at the direct observational level, would not seem to be in their interest, or indeed would seem directly contrary to it. For example, priests and religious who choose a celibate life, martyrs who die rather than renouncing their faith, even ordinary people who sacrifice by giving large sums of money for religious purposes.

8. USE OF REALITY BY POSTULATION.

In science, reality is postulated by a scientific hypothesis, and then (ideally) the postulated reality is investigated to determine if it indeed corresponds to our experience of reality, as discussed above⁴³. Thus one can postulate entities such as atoms or subatomic particles, and then perform experiments to determine if they are, in fact, real. Similarly one

⁴³ FOWLER, Thomas. "Reality in Science and Reality in Philosophy: Importance of the Concept of Reality by Postulation", *The Xavier Zubiri Review*, Vol. 7 (2005), p. 39-54.

can postulate a scientific law, such as Newton's law of gravity, and then perform the necessary experiments to verify that it accurately describes the motion of bodies under the influence of gravitational forces. The real issue for science is not why we can describe reality with our theories, but *how well postulated reality corresponds to reality beyond apprehension*. We can describe reality with our theories because they *postulate* it. For example, phlogiston was postulated to account for observed transformations in combustion⁴⁴. But further research disclosed that there is no such entity—it did not correspond well with reality beyond apprehension. However the postulation of subatomic particles such as electrons, photons, and quarks has proved useful. Thus in science, postulation of reality is a step in the process of scientific discovery.

In theology, postulation of reality takes a different form: it *creates* reality rather than *discovering* it⁴⁵. Jesus gave Peter and the Church the power to "bind" and "loose", i.e., make rules about what is moral and what is immoral, and what conduct is proper and what conduct is improper. The Church is *postulated* as an entity, and as such it has *real* power. Jesus did not say, "the rules are already made, you just have to enforce them"; he said that *you* (Peter and the Church) have the power to make the rules and enforce them. Of course, this did not mean that the Ten Commandments had been superceded; but it did imply that the Church—now a real entity—would have the power and responsibility to make rules about morality—in effect, ruling about what is sinful, and also to forgive sins. It would not be simply carrying out preestablished mandates. Moreover, and indeed much more importantly, these rules are "bound in heaven" as well as on earth. Or in other words, *reality by postulation does not create entities in a nominalistic sense, but in a real sense*. (Of course, in some areas of theology, reality is postulated and then investigated by reason, e.g., speculation about the nature of God and the Trinity; but theology does not rely upon the type of empirical methods that characterize science.)

⁴⁴ LOY, Jim. *Phlogiston Theory*, <http://www.jimloy.com/physics/phlogstn.htm>.

⁴⁵ FOWLER, Thomas. A Framework for Political Theory Based on Zubiri's Concept of Reality, *The Xavier Zubiri Review*, Vol. 4 (2002), p. 109-132.

SUMMARY AND CONCLUSION

The present advanced state of science means that the general outlines of the relationship between theology and science are readily understood, even though details remain to be worked out; and of course advances in science can compel a rethinking of the question. The scientific, the metaphysical, and the theological are closely connected, because all are forms of knowledge emerging from reason or third level of human knowing, and all speak about reality. Nonetheless, articulating the relationship between among has been a difficult problem for at least three centuries. Reality unfolds in events that can be observed by the sciences, which indeed allow us to observe aspects of it which would otherwise remain hidden. However neither science nor any other form of knowledge can capture *all* of reality. That is, human knowledge of reality can never be complete, whether based on philosophy, science, literature, or any other form of knowledge based at the level of reason. Science utilizes a particular methodology and a canon of reality in order to proceed; both are subject to revision, and the canon may vary from one scientific field to another. Neither of the two can be proved within science itself; the methodology can only be judged in the total context of human knowledge, and the canon of (scientific) reality ultimately is a subset of reality in general. Theology, like philosophy, utilizes human reason based on our direct contact with reality. However, it also has other sources, in particular revelation, which gives it an authority that other forms of knowledge do not have. And ultimately theology sees beyond science, to ultimate reality, and even sees ordinary things at a level inaccessible to science. Science and theology differ in eight key areas:

1. The *object* of their knowledge
2. Their respective *manners of investigation*
3. The *levels of knowledge* each involves
4. The *levels of reality* at which each operates

5. The *number of levels* at which their respective statements can be understood
6. The *goals* of each
7. The *source of their knowledge and corresponding authority*
8. Their use of postulation to achieve their goals

All human knowing is of the real, because reality is the formality under which man apprehends anything. In man's quest for understanding, the utilization of scientific concepts, amplified and interpreted, only supposes that the sciences are an appropriate way of access to reality. Philosophy and theology, in turn, reflect on the data offered by the sciences as "data of reality". But philosophy and theology are not looking to duplicate the efforts of science. Both philosophy and science examine the "world", that to which the field of reality directs us. Science is concerned with the "talitative" order, the "such-and-suchness" of the world, how such-and-such thing behaves; whereas philosophy is concerned with the respective unity of the real *qua* real, with its transcendental character, what makes it real⁴⁶. Philosophy (and theology) thus ask questions that *cannot be meaningfully expressed in scientific language*. But both philosophy and theology rely to some extent on science to tell us about the world. What science tells us, for example about causality, needs to be incorporated into the vision of reality that philosophy seeks, and thus impacts theology, for example with respect to proofs of the existence of God. Note that the unfolding of reality, even that whose understanding is mediated by science, is still an unfolding that requires a direct, sentient connection with reality, one that is no different from its unfolding through personal experience, poetry, music, or religious experience.

⁴⁶ ZUBIRI, Xavier. *Inteligencia y realidad*, p. 127-132, English edition, 48-49; *Inteligencia y logos*, p. 266-268, English edition, p. 197; *Inteligencia y razon*, p. 335, English edition, p. 219.

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