

From Galileo to Whitehead-
Century- Specific Questions of Current
Import to Science and Faith

Galileo was the initiator of the Copernican revolution. Whitehead might be thought of as the latest representative of that continuing transformation. In between these two are four centuries of dialogue between science and the Christian faith. Barbour (1966) suggested that each century (from the seventeenth through the twentieth) dealt with a unique set of issues which evolved from one another as scientists and religionists explicated the implications of their endeavors for their science and their faith. In this presentation the four major issues of these centuries are considered. Their import for the contemporary scene will be discussed. The thesis to be considered is that these issues are still current and, while they may be expressed in disguised form, they are still the dominant concerns which should be addressed in any creative interface between religion and science. Not unlike the heresises considered by the great councils in the first 600 years of Christianity, these dialogues among scientists, philosophers, and theologians between the seventeenth and twentieth centuries are not dead but can be seen again and again in modern discussions. To become aware of their timelessness and their timeliness is a worth while endeavor.

The seventeenth century was concerned with defining science as that endeavor which described things in terms of "efficient" rather than "final" causes. This allowed religion to deal with ultimate purpose, first cause, and overall design. No conflict was perceived but

inherently religion began to assume less than a central place in human affairs and humans themselves, like the earth in the Copernican paradigm, were relegated to a position of secondary importance.

The eighteenth century was known as the "age of reason". Initially conceived as the God like quality in humans which allowed them to perceive God's great design, reason came to operate independently of its proported origin and to function as the enemy of the "God hypothesis". Nature was seen as a self sufficient deterministic mechanism whose operation could be explained by natural forces. Religion maintained its integrity by insisting along with Kant, in the distinction between "theoretical" and "practical" reason and by claiming the issues of everyday life for its own - leaving theoretical reason to science. Pietism was the expression of this resolution of the potential conflict between religion and science.

The nineteenth century was the period of conflict between evolution and religion. Here, as in no other century, the uniqueness of man and the assumed purpose and design of the universe were brought into question. Threats to the authority of the Bible and the origin of morals were also prominent. Religionists insisted that God worked through the evolutionary process and that religion was not a matter of belief as much as of experience. Schleiermacher set the stage with his theory of religion as absolute dependence. Kierkegaard developed the theme of decision and the revivalists insisted on sanctification and social

justice. Others, however, continued a "God of the gaps" position in which it was insisted that science could not explain everything.

The twentieth century has been the battle ground of positivism and linguistic analysis. In part, these issues have been restatements of all the controversies of the previous centuries. Many scientists have perceived religion to be outdated and meaningless in a world come of age. Religionists have protested either through calling attention to the need for values beyond technology and through restatements of man's need for final answers to meaning which science cannot give. Others have protested that religious language is meaningful in a different sense than that of science and have termed religious beliefs analogical rather than denotative.

A broader discussion of these issues will be undertaken. Their particular relevance for psychology and religion will be detailed. Thus, the current dialogue between Christian theology and the social/behavioral sciences will be grounded in the intellectual history of the last four centuries and the importance of continued certain major questions will be perceived.

The Seventeenth Century

The seventeenth century is often depicted as the century in which modern science emerged. The landmark event which signalled this emergence was the publication in 1632 of Galileo's Dialogues. He popularized what Copernicus had proposed one hundred years earlier, namely, that a heliocentric model for the universe was more mathematically simple than

a geocentric one. Through his telescope he was able to demonstrate the truth of Kepler's suggestion that the orbits of the planets were elliptical rather than circular as in the Ptolemaic system. By experiments such as rolling a ball down an inclined plane he was able to explain motion through mathematical equations involving length, time and velocity. Increasingly Galileo promoted a new science based on quantitative rather than qualitative relationships which had been the foundation of the medieval synthesis of knowledge grounded in the writings of St. Thomas Aquinas. Careful, rather than everyday, observation was the way to study nature. The world of the scientist was, to Galileo, the world as "we do not experience it" (Barbour, 1971, 1966, p. 25). "Mass", and "velocity" replaced "color", "taste" and "sound" as important categories. Galileo sought to study the permanent, not the subjective, qualities of nature. Further, change to him meant less the scholastic notion of transition from potentiality to actuality and more the rearrangement of particles in space and time. He was less interested in why things function than in how.

These ideas would probably have provoked far less attention than they did had not Galileo insisted on publishing his findings and on writing in the language of the average Italian. Copernicus had withheld De Revolutionibus for many years and wrote in German which made his ideas virtually unknown to the average Italian over whom the church was concerned to maintain control. Nevertheless, only one year after the publication of his Dialogues, in 1633, Galileo was condemned, ex-

communicated from the Roman Catholic church and the reading of his writings prohibited.

It is of great historical and theoretical interest that Galileo later recanted and was received back into the church. As Barbour (1966,1971, p.29) states, "Galileo himself was a devout Catholic and found no conflict between his scientific and religious beliefs". He was perhaps somewhat naive to assume that changing the center of the universe away from human beings to an unknown fiery mass such as the sun and that altering the explanation of change from beings realizing their God given potentials to force acting on mass would not threaten the authorities. He, however, distinguished between scientific and religious knowledge and felt that scripture, not reason or observation, contained the spiritual knowledge necessary for salvation. Physical matters, on the other hand, should be approached from observation and mathematical reasoning. Yet, according to Galileo, both scientific and scriptural knowledge were ways of knowing God. The only difference between this and Aquinas' notion that natural theology was a preamble to revealed theology was that Galileo put nature and scripture on an equal basis. The church was intuitive enough to anticipate that this was a precursor to the relegation of human salvation to a secondary place and even a replacing God in nature by mechanical law. Both of these possibilities came to pass.

In reflecting on the legacy of the seventeenth century as depicted in the experience of Galileo, several themes are important to note: First, the understanding of the Bible as a source of inerrant knowledge about earth as well as heaven was challenged; Second, the

place of the human being shifted from being the center of the universe to being an observer of natural events; Third, religious scientists saw themselves as discovering mathematical laws which explained how things functioned (efficient causation) but left ultimate questions of where things came from or were headed toward (ultimate causation) unanswered or left to the church; Fourth, subjective experience was seen as of less import than controlled observation. Secondary qualities such as sound, taste, color, feelings were considered just that, i.e. "secondary" in importance to primary qualities such as mass, velocity, friction, etc. Although, not observable in the ordinary sense, these qualities were considered to be the necessary ingredients for explaining events in time and space. Essence came to be less what God intended in creation and redemption and more interacting particles which could be explained by mathematical law; Fifth, the seventeenth century set the stage for concerns which still occupy attention in the science/religion dialogue, namely, how it is possible to believe in a mechanical world and a personal God? What is the relationship between first, efficient, and final causation? And how is the language of the Bible and the language of the scientist to be related to each other?

The Eighteenth Century

The eighteenth century was dominated by the figure of Sir Issac Newton. Although his Principia was published in the seventeenth century (1687) his influence was predominantly felt in the eighteenth when science began to come of age. Newton finished what Galileo pioneered, namely, the alliance of mathematics and experimentation. Further,

he invented calculus as the means par excellence for describing how the world functions. Like Descartes, who was a contemporary of Galileo, Newton saw mathematics as the language by which God spoke to nature just as scripture was the way he spoke to peoples' souls. Again, he trusted his reason to correctly perceive reality and his intuition to correctly label what he saw. The apocraphal story of Newton and the falling apple which resulted in the "discovery" of gravity illustrates this process. Gravity was to Newton a label for a force he recognized and could measure but about whose nature he remained unaware. This he saw as the task of the scientist, namely, to remain descriptive and free from metaphysical speculation. Science was functional even when its knowledge was not exhaustive. Newton was careful to leave metaphysics to religion.

Nature became, thus, a law abiding machine. As Barbour notes, "This was still a single harmonious order, as in the Middle Ages, but now it was a structure of forces and masses rather than a hierarchy of purposes" (p.35). A machine, rather than an organism, became the central motif by which to understand the world. Like a mechanical apparatus, nature followed immutable laws which could be discovered. Scientists became so intrigued with the discovery of these laws (efficient causes) that they completely ignored or judged as irrelevant issues of first or final causation. Nevertheless, Newton himself and the other members of the Royal Society of England were religious men from Puritan backgrounds and they did not discount the place of God in these matters. They believed that this world machine was designed by an intelligent creator and that the world was the expression of his purpose. As

Robert Boyle noted, science was to these men a "religious task". They assumed that the very faculty by which God's laws were discovered, i.e. human intelligence, was itself evidence of God's orderliness and that it was His intention that humans apply themselves to the discoveries of the laws of creation. Thus intelligence, rather than immortal soul, became the unique feature of the human being. This idea was a significant *départure* from the medieval point of view and signified a new era in which religious living would be understood as using one's mind to know more and more about the world rather than to prepare oneself for heaven.

Further, nature became not only a source for revelation alongside scripture, but the preeminent method for knowing God. Nature, not history, became the clue to the divine. This, too, was a move away from the Christ centered human experience orientation of Catholic as well as Protestant Christianity. The emphasis was on God the Creator instead of God the Redeemer. Rational religion, as it was called, contended that the "design" that was being discovered by the scientists was unquestionable proof of an intelligent "designer". As Newton himself stated:

Whence is it that nature doth nothing in vain;
and whence arises all that order and beauty which
we see in the world? How came the bodies of
animals to be contrived with so much art, and for
what ends were their several parts. Was the eye
contrived without skill in optics...Doth it not
appear from phenomena that there is a being in-
corporeal, living, intelligent...(Newton, 1721,
p.344 quoted in Barbour 1966, 1971, p.38).

The reasoning was "from nature to nature's God" as one scientist put it. The spirit of the age was expressed by Addison's well known hymn,

"The Spacious Firmament on High", to wit:

The spacious firmament on high, With all the blue
ethereal sky
And spangled heavens shinning frame, Their great
Original proclaim.

The unwearied sun from day to day, Does his Creator's
power display,
And publishes to every land, the work of an Almighty
hand. (quoted in Barbour, 1966, 1971, p.37).

In reflecting on the legacy of the eighteenth century as depicted by Newton, several themes are important to note:

First, St. Thoma's concern for divine purpose in all creations was brought in the back door with the scientific emphasis on the divine benevolence in the design of all things. However, in spite of the fact that the scientists often presumed that the purpose of nature was for the convenience of man, they yet saw these purposes as external to the process itself which they envisioned as a self complete, mechanical system not striving toward any designated end. Thus, God was seen as first cause at best. Final causes were of no concern.

Second, such images of God was the "Divine Clockmaker", suggested by Robert Boyle, led to the conclusion that God's activity was completed in the act of creation and that the world was functioning without any further interference by Him. Newton did not hold to this opinion insisting that God continued to "adjust" the traditional view of God who was perceived as not only creating but sustaining the world. This was one further departure from the universe. His followers, however, rejected the notion of God's continuing action. The religion of the average person held to this faith and through prayer and worship imagined that s/he made contact with a personal God who cared and acted in behalf of individuals. The religion of the Deists, as these scientific

religion to be called, was quite different from this.

Scientists increasingly turned away from traditional Christian universalism, atheism or skepticism. Universalism was the alternative to special revelation such as Christianity. It insisted that the creator of the universe could be known by all persons everywhere through the universal language of nature. No special revelation such as came through scripture, needed. Great tolerance was advocated. Others turned to atheism. The laws of nature were thought by them to be self evident and entirely explainable by the laws of mechanics. As Laplace said when asked what God played in his theory of planetary motion "I had no need of hypothesis". Many came to agree with him. Finally, those who questioned the concept of design itself. They were skeptics who doubted not only that the laws were divine but that were anything more than convenient fictions of people's minds. They questioned the "realism" which lay beneath the trust the average man had in his ability to comprehend nature.

For the Pietists on the one hand and the Romantics on the other against the sterility of rational religion and the concern to reduce nature to its smallest components. In a desperate attempt to reclaim the traditional emphases of Christianity on inner religious experience the Pietists discounted the relevance of scientific discoveries and advocated a personal concern for holy living and conversion. The Romantics, reacting from a secular rather than religious point of view, criticized science for a restricted interest. Instead of reason being at the center of life, the Romantics suggested that emotion and imagination were the

prime facts of nature. They emphasized human experience not the physical environment. They were concerned with individuality, freedom, and wholeness rather than universals, predictability and analysis. As Wordsworth said in his poem "The Tables Turned",

Our meddling intellect
Mis-shapes the beauteous form of things
We murder to dissert.

(Barbour, 1966, 1971, p. 67).

Thus, the place of the human being was reaffirmed in a reaction to cold logic of the scientific enterprise.

Finally, Immanuel Kant, writing toward the end of the century provided an approach to the reconciliation of science and religion which was quite different from that provided by the Pietists or the Deists. For him science was theoretical reason based on sense experience and the logical ordering of the human mind. Religion was something distinct from that in that it included practical reason based on moral obligation which one knew by inner conscience. Both were necessary but each had limitations. He reportedly said he believed in both the starry heavens above and the moral law within. They were not contradiction to each other although neither could lead to the other. Kant stated, for example, that he had "found it necessary to deny knowledge in order to make room for faith" (Kant, 1950 translation, quoted in Barbour, 1966, 1971, p.74). However, Kant's God was more a postulate of the moral order than the God of the Bible. Nevertheless, he like many others since, proposed that the moral experience of conscience provides justification for saying God is real. It is practical knowledge, not theoretical proof. Science, on the other hand, provides knowledge of the world filtered through the categories of the mind (e.g. time, space, causality, substance). The world as it really is can never be known apart from the

knower. Trust in human reason as a channel for reality all but died with Kant's insight about the limitations of science. Thus Kant made a place for both science and religion and answered the skeptics, such as Hume, in so doing.

The Nineteenth Century

For religion and science in the nineteenth century the significant events occurred in 1859 and 1871 with publication of Charles Darwin's Origin of Species and The Descent of Man respectively. As Barbour stated, these publications challenged the purpose and design of the world, threatened human dignity and called into question the character of the authority of the Bible (1966, 1971, p.81).

Until the beginning of the nineteenth century there had been little doubt that the world was created instantaneously in its present form. However with the discovery of fossils it became apparent that certain events had occurred and passed into oblivion. Catastrophism was the term applied to the view that God had created the world through a series of catastrophes while uniformitarianism was the view that these changes had been the product of natural causes operating over great period of time. The latter view was predominant by the second quarter of the century due to the writings of Charles Lyell.

However, even Lyell's work did not alter the prevailing view of the fixity of the species, i.e. that each animal developed through separate lineages. Little attention had been paid to Lamarck who had espoused unlimited organic change as a function of specie adaptation

to the environment.

Thus, until the time of Darwin there was very little conflict between science and religion. Change in the earth's form and even development of species could be understood in a Deistic fashion as God's way of creation. Human beings still could be conceived as the apex of this divine creation since it was assumed that biological forms were stable through history. The argument from design still held true.

Darwin changed all that. Although his first book avoided mentioning human beings his later book, The Descent of Man, was written with the specific intention of including them. In the twelve years between the two volumes Darwin became convinced that humans followed the same laws he had postulated for plants and animals, namely, random variation of structure and function, the struggle for survival, and the survival of the fittest. In defiance of his critics (mostly religionists trying to protect the sanctity of the human being) Darwin suggested that people, like all other parts of nature, became who they were by an historical process not by some direct act of creation.

Initially Darwin's proposals were a challenge to the argument from design. Design, instead of being a preordained purpose, became the word applied to the product of a process. However, if one presumed that God was the first to cause the process by which development had occurred seemed like random selection and the result would appear to be less "law" and more "chance". As Loren Eiseley suggested:

"Darwin did not destroy the argument from design. He destroyed only the watchmaker and the watch." (quoted in Barbour, 1966, 1971, p.91)

Secondly, Darwin's proposals challenged human dignity in that the distinctiveness with which persons had been held in the western tradition was now lost because humans were no longer outside nature but in it. Huxley reportedly concluded that there was now less difference between the highest apes and lower forms of life made man a product of history and environment. Even man's moral sense, which Kant so strongly noted, was hereby considered to be a product of evolution - not of creation. Reductionism became the rule of the day and evolution was utilized to explain away almost all higher mental faculties in human beings.

On the scientific side evolution brought optimism about human ability to discover all knowledge and about progress in solving human social problems. Competition was glorified as a process to be stimulated and encouraged because it had brought civilization to its state. Religion was seen as a stage along the road of progress. Many scientists called for an end to religion and an ushering in of the age of science - all in the name of evolution.

Religion reacted in a variety of ways. There were those like Schleiermacher who denigrated the whole scientific enterprise as it pertained to religion by insisting that the core of religion lay not in perceiving the great design or in experiencing the demand of conscience but rather in a feeling of absolute dependence. Thus the emphasis was drawn back to religious experience, a theme dear to the traditionalists.

There were others like Ritschl who also denigrated science and evolutionary theory in favor of a call for morality. This re-statement of Kant laid the foundation for the social gospel which was influential in the life of liberal Christianity in the twentieth century.

However, there were other religionists who reacted vehemently to the theory of evolution seeing in it both a threat to human dignity and to the authority of the Bible itself. Not only did Darwinianism call the creation saga into account it also provoked historical criticism which considered the Bible itself to be a production of evolution. The battle became very acrimonious and bitter. The seeds of fundamentalism were laid in the latter half of this century and were to reach fruition in the early part of the twentieth. Science was thus seen as the opponent of religion. In turn, many scientists became atheists and saw religion as the vestige of an age gone by.

The Twentieth Century

The twentieth century is characterized less by one dominant figure than by two themes which both restate the past and provide new thrusts for the dialogue between religion and science. These are: the viewpoint that religion and science are different enterprises and therefore are not in conflict (cf Galileo, the Pietists, Kant and Schleiermacher) the viewpoint that religion and science parallel each other and can mutually inform each other (cf Newton, the Deists, the religious evolutionists, and Ritschl).

The first viewpoint, that religion and science are different and therefore not in conflict, suggests that the metaphysical assumptions so prevalent in Newtonian science are inappropriate extensions of scientific theory. Science, as Galileo concluded, only describes what it can see through controlled observation. It cannot go beyond the data to postulate a first cause or an immanent divine presence. As Hume stated, the design is in the mind of the scientist not in the world. Thus science and religion differ both in content and in approach. Neo-orthodoxy (exemplified by Karl Barth) reacted to the liberalism of the nineteenth century which had accommodated itself to science by seeing God as no more than a force within the evolutionary process and by reducing Jesus Christ to a good man. Furthermore, liberalism had seen sin as a stage in human progress and divine revelation as the label for human attempts to discover God through religious experience, morality, and rational reflection.

In typical bombastic fashion Barth said "NO" to all of this. He insisted that God revealed himself on His own terms and in contradiction to efforts to discover or find Him. While he postulated a place for science he considered its findings "epiphenomenal" as compared to the "real" knowledge given to humans by God's self revelation in scripture. He said there was a radical difference between revelation and natural reason (science), between Christ and other people, and between God and the world. On occasion, "ye and ~~ye~~", God through His Holy Spirit reveals Himself to the world. Only then is religious knowledge available.

And always God comes in judgment and forgiveness; judgment upon human understanding and forgiveness for human pretension that suggests knowledge of God is irrelevant.

The opposite reaction from the scientific position was the logical positivism of the Vienna Circle of philosophers of science in the 1930's. Agreeing as they did with Hume that all that the human mind can know is sense perceptions and that what is called causality is simply the connecting of these impressions, these philosophers suggested that scientific theory was not a true reflection of the world as it really is (cf Kant's "the thing-as-such) but a device of convenience that made communication and prediction possible. It was but a short step from this assertion to the proposition that the only "meaning" theoretical statements could have was in terms of the sense impressions to which they referred. This "verification principle" made all the statements of theology or religion neither true nor false - just meaningless. They were called "vacuous pseudostatements" which merely expressed the religious speaker's emotions or feelings. Thus, the logical positivists came to the same position as did Barth but for different reasons and with different results. Not only were science and religion not related but only science had any meaning. Barth had said the reverse, i.e. only religion had meaning.

More temperate voices since the logical positivists have suggested that while religion has no meaning in a denotative (reference to point-atable sense data) it does have a variety of other connotative meanings. This position, represented by the philosopher John Hick, sees language as serving a variety of functions and science as

representing only one of them. Language can connote an orientation to life, ultimate concern, attitudes toward existence, value predispositions and commitment. These are especially meaningful within a worshipping community such as the Christian church or the Jewish synagogue. Thus, while religion and science are disparate, they are both valuable and serve different functions.

The other major point of view sees science and religion as parallel and noncontradictory modes of understanding reality. The sense that the two are not in conflict has been espoused in one guise or another since the time of Galileo and Newton. Liberal theology was the name given to this mood in the nineteenth century as religionists accommodate themselves to evolutionary theory. The themes of this group perceived the evolutionists as describing the ways an immanent God worked in history. They concluded that Jesus was but an example of the goodness in all persons and they optimistically suggested that with proper effort everyone could achieve divinity. They called for changing society by human effort and for using evolutionary theory to the advantage of religion. They saw no difference between human reason and divine revelation and suggested that both enterprises could learn from each other. Even logical positivism did not threaten this group for they reinterpreted theology as but the attempt of religionists to organize their experience of the transcendent. Thus religious language was similar to scientific theory. It, too, referred to sense impressions.

The most complete attempt to unite science and religion within one view of reality has been that of Alfred North Whitehead through what has come to be known as "Process Philosophy". Whitehead, himself a mathematician and philosopher of science, boldly brought metaphysics back into consideration by suggesting that all persons operated with implicit assumptions about reality even when they thought of themselves as simply organizing sense data. This was but a restatement of the "personal equation" in all theorizing which had been noted for well over a hundred years but to which little attention had been paid. He also stated that any unified view of reality must be applicable to experience. In this he agreed with the logical positivists. It was possible, he thought, to bring both scientific and religious evidence to bear on theory construction.

For process philosophy the world is in a state of becoming. Time is the important category as the evolutionists concluded. Secondly, all events interpenetrate on each other and no single event is devoid of influence from all other events. Reality is organic rather than mechanistic and events can be created by self-conscious entities such as persons. God is Himself not static but evolving and co-creating with human beings the world that is to come. Science and religion are, therefore, different viewpoints on the same reality. Both are needed for a coherent and truthful metaphysics. There is a "reality" but it is in a state of flux. However, humans can grasp it and be a part of it.

Conclusion

Thus the twentieth century expresses the fruition of all the centuries before it. In the issues of today are the seeds of the past four hundred years. What began with Galileo is today consummated in Whitehead. The ferment is by no means over and there is no common agreement on the manner in which science and religion are to be related, as auspicious as Whitehead's scheme may be. The options of the day range from the complete denigration of either enterprise to reductionistic explanations to complementary perceptions to levels of reasoning to amalgated interpretations. It is important to note that no one of these options is new to the twentieth century. They all have their roots in the dialogues that preceded them. Heresies are rampant and the issues are not new. Suffice it to say that psychology occupies a unique position in the debate for from its very inception it has been subjected to critique and question. Unlike geology, for example, it has been unable to forego discussions because it has taken as its object of study the human being - defined either as consciousness or as behavior. It has been caught in the middle of these issues whether it wishes to be or not. Thus, dealing with the science/religion dialogue has not been an option. Either implicitly or explicitly it has had to deal with the questions to which scientists and religionists from Galileo to Whitehead have attended. Such a survey as this may make such as us more aware of our heritage and more literate in our conclusions.

Reference

Barbour, Ian G. Issues in Science and Religion. Englewood
Cliffs, New Jersey: Prentice Hall, 1966.