

Logos, Rationality, and the Quantitative Development of Scientific Law

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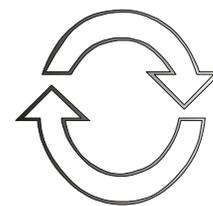
The philosophical underpinnings embraced by the Classical Greeks can be divided into three basic categories: (1) how they viewed nature and time (metaphysics), (2) how they viewed reason and experience (epistemology), and (3) how they viewed living (ethics).

Metaphysics

Regarding Greek metaphysics, let us investigate their understanding of the nature of nature, the nature of order, and the nature of time. Greek philosophers believed in the divinity of nature calling the universe *monogenes* (μονογενες) meaning “the only or uniquely begotten.”¹ According to Aristotle (384-322 BC), the motion of the heavenly spheres is animated by an incessant desire (or a form of “animal” love) for the Unmoved Mover, which to him was impersonal and immanent. Not only was the universe divinely animated, it was eternal.² To the ancient Greeks, the universe was not merely the Supreme Being; it was the Supreme *Living* Being. This pantheistic and animistic concept that the universe was the “Supreme Living Being” was culturally pervasive.

To Greek philosophers, the universe revealed order due to an inherent, imminent, and impersonal *logos* (λογος). *Logos* is a very rich word. In our modern age, it is used primarily as a suffix meaning “the study of” (e.g., anthropology, biology, zoology, topology, etc.). To the Greeks, *logos* encompasses the idea of word, communication, interconnectedness, comprehensibility, or reason.³ In Pythagorean mathematics, *logos* reflected proportion or ratio with an associated connection to measurement.⁴ The Greek philosopher Heraclitus (544-484 BC)⁵ first used this word in a metaphysical context, stating that everything is, and will be, eternally living *fire*. This fire he called *logos*. He used fire as an image of *logos* (reason) which is *the main feature of everything*. In this context, he was perhaps the originator of the *natural law* concept, a belief that common wisdom pervades the entire universe. The *logos* or reason that is behind and in everything is non-moral, neutral, and indifferent to notions of justice, righteousness and compassion. *Logos* is *within* nature and can be discovered by man’s mind. Later, the Stoics,⁶ founded by Zeno of Citium (ca. 335-ca.263 BC), nuanced *logos* by equating it with matter. Matter, the *only* reality, is the reason or virtue that permeates and controls everything that happens.

Concerning time, Greek philosophers understood it as being circular and cyclical. You can catch a hint of some of the ramifications of a commitment to cyclical time when Aristotle said, “... probably each art and each science has often been developed as far as possible and has again perished.”⁷ In his opinion, the mathematics, science, the arts, and craftsmanship of his day had already risen to their highest point of achievement (destined to degenerate to its low ebb and, in the next cycle, return to its maximal point again). Even the meaning of the Greek word for education, *paideia*, meaning “to draw out from” carries within it the ability to recollect or remind oneself of knowledge gained in a previous existence (or cycle). This ideological commitment turned out to be a death knell for progress and development in Greek culture (even in the area of mathematics in spite of some wonderful and insightful accomplishments).



¹ In Latin, *monogenes* is translated *unigenitus*. For examples of its usage by the ancient Greeks, see Gerhard Kittel, ed. *Theological Dictionary of the New Testament*, 10 vol. (Grand Rapids: Eerdmans, 1964-76) under “monogenes.”

² To Aristotle, the notion of a once for all creation at the beginning of time was absurd and repugnant.

³ The Pythagoreans (ca. 6th century BC) used the Greek word *alogos* (literally means “no reason”) to express the number irrational number $\sqrt{2}$.

⁴ A rational number, the epitome of reason, is the *ratio* of two integers *a* and *b* where $b \neq 0$. See William McGowen Priestley, *Calculus: A Liberal Art* (New York: Springer-Verlag), p. 75, where he states that *logos* of proportion is closely related to *measurement*. While natural numbers are needed to *count* objects, rational numbers are needed to *measure quantities* such as length, area, volume, weight, and time.

⁵ Heraclitus is famous for the statement “you can never step twice in the same river for the waters are ever flowing past you.” He also said that the sun changes every moment and that it is one foot in diameter.

⁶ From the Greek word *stoa* meaning “porch.” Stoic philosophers originally discussed their ideas around a porch.

⁷ *The Metaphysics*, 1074b.

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Epistemology

Aristotle said, “All men by nature desire to know.”⁸ Greek philosophers employed two methods to illustrate how one comes to know anything. The first method is rationalism (i.e., man is rationalistic or man knows on the basis of thought). This is the “stop and think” method. The human mind, on its own, can fathom and understand the truth about all things (related to this life, mathematics, and the cosmos). Philosophically, this is the *a priori* (from the previous) path to knowledge. An extreme rationalist⁹ tends to exclusively rely upon the mind’s ability to conceptualize truth believing that some (or most) knowledge is independent of observation, experience, or sense perception. Examples of rationalists in Greek philosophy are Anaximander (611-547 BC), a student of Thales, and Plato (427-347 BC). The Stoics were rationalists in that they posited that knowledge is based upon *perceptive* sensations. Because perceptions are understood by the mind, knowledge to the Stoic is merely and only a mental construct, an idea that became a precursor of the intuitionist epistemology of Immanuel Kant (1724-1804).

The second method is empiricism or the “look and see” method, the *a posteriori* (from the consequent) path to knowledge. An empiricist states that the mind can make mistakes and that we must therefore rely upon our observations and senses in order to determine the truth about things. A radical empiricist (i.e., empiricism absolutized) tends to exclusively rely upon observations believing that all knowledge is dependent on observation. Examples of Greek empiricists are Thales of Miletus (636-546 BC) and Aristotle in some respects.¹⁰

Throughout history, we see these two methods played out in their radical form. Rationalism has found its way into the theories of mathematical foundations in terms of the intuitionism of Luitzen Brouwer (1882-1966), taking a cue from Kant, the logicism of Bertrand Russell (1872-1970) and Alfred North Whitehead (1861-1947), and the formalism of David Hilbert (1862-1943). Radical empiricism is reflected in the logical positivism of Auguste Comte (1798-1857) who stated that truth is that which can *only be verified scientifically* (i.e., by observation).

Ethics

The Greek view of living, like epistemology, varied from one extreme to mean to the other. At its roots, man is the determiner. Due to their mathematical metaphysic (all is number¹¹), the Pythagoreans believed that the good life is the contemplative life. To properly exercise reason in its pursuit of knowledge, one must learn to live an ascetic life; a life emancipated from material comforts, overindulgence, and bodily desire.¹² Note especially how one’s metaphysical, epistemological, and ethical notions network or interconnect. Aristotle’s “golden mean” is the ethic of “moderation.” Epicurus (341-270 BC) embraced an intellectual “hedonism” where man’s ability to reason is accentuated by good conversation over “wine and cheese.” For the Stoics, man must strive to be at peace with the immanent *logos* of nature by (1) freeing oneself from passions, (2) being unmoved by grief or joy, and (3) submitting without complaint to whatever happens (as an unavoidable necessity).

The Foundations of Rationality and Quantification

The Greek philosophy of rationality and nature can be summarized as follows:

1. The Greeks founded their thinking on the neutral autonomy of man’s mind (i.e., man can know truth by thought alone).
2. The Greeks embraced a cyclical view of time and history.

⁸ *The Metaphysics*, 980a.

⁹ There is a difference between positing man as rational and man as rationalistic. To posit man as rationalistic absolutizes reason *as the only way to valid knowledge*.

¹⁰ Aristotle was an empiricist in biology and a rationalist in cosmology and the physics of motion.

¹¹ The Pythagoreans made a critical error in their metaphysic of number. They believed that number *generated reality* instead of viewing number as a tool that *reported on reality*.

¹² Note how Plato incorporated these Pythagorean notions in his commitment to the priority of abstract forms over the “evils” of matter.

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3. The Greeks believed in the divinity and eternity of nature. They also viewed nature as a living and animistic organism.¹³ Nature revealed a rational order due to an inherent, imminent, and impersonal *logos* (reason or natural law). This rationality of nature was not a *full* rationality; the perfect circular orbits of the celestial realm revealed such perfection while the imperfect terrestrial realm was subject to a degree of relative irrationality.¹⁴ Why? Quasi-divine animistic impulses were potential sources for irregular or “chance” processes.

These Greek philosophical underpinnings *permeated* the culture of Rome in the first century AD because Rome permitted Greek slaves to educate the populace. Into this mix came new ideas fostered by the coming of Christ. According to mathematics historian Morris Kline (1908-1992), these ideas offered no avail to the furtherance of mathematics: “From the standpoint of the history of mathematics, the rise of Christianity had unfortunate consequences.”¹⁵ Dr. Kline reverses this opinion in his analysis of the men behind the Scientific Revolution:

The work of the 16th-, 17th-, and most 18th-century mathematicians was ... a religious quest. The search for the mathematical laws of nature was an act of devotion which would reveal the glory and grandeur of His handiwork.¹⁶

Each of the great intellects possessed a combination of mathematical or scientific genius and religious orthodoxy which today are regarded as incompatible and possible only in a period of transition.¹⁷

Scientists today have kept apart from their professional work the religious convictions that formerly motivated some of the finest research in the sixteenth to eighteenth centuries. From the modern viewpoint, the inspiration that these mathematicians and scientists drew from religious beliefs seems strange.¹⁸

What made the difference? German historian Oswald Spengler (1880-1936) once said that the “history of Western knowledge is thus one of *progressive emancipation* from Classical thought.”¹⁹ From the first century to the 16th century, something changed in terms of the understanding of the *nature* of nature. Science historian Alistair C. Crombie (1915-1996) links this emancipation not only to the technological innovations of the time, but to the scientific instruments of the future:

In Western Christendom during the early Middle Ages men were concerned more to preserve the facts which had been collected in classical times than to attempt original interpretations themselves. Yet, during this period, a new element was added from the social situation, an activist attitude which initiated a period of technical invention and was to have an important effect on the development of scientific apparatus.²⁰

The historian Alfred Crosby amplifies Crombie’s observations:

Westerner’s advantage, I believe, lay at first not in their science and technology, but in their utilization of habits of thought that would in time enable them to advance swiftly in science and technology and, in the meantime, gave them decisively important administrative, commercial, navigational, industrial, and military

¹³ See Stanley L. Jaki, *The Relevance of Physics* (Edinburgh: Scottish Academic Press, [1966, 1970] 1992), pp. 3-51.

¹⁴ In this context, Aristotle developed two different kinds of physics for the two realms, one involving straight-line motions and the four ordinary or terrestrial elements (i.e., earth, air, fire, and water), the other involving circular motions and a fifth element, the “quintessence,” not found on Earth.

¹⁵ Morris Kline, *Mathematical Thought from Ancient to Modern Times* (New York: Oxford University Press, 1972), p. 180.

¹⁶ Morris Kline, *Mathematics: The Loss of Certainty* (New York: Oxford University Press, 1980), pp. 34-35.

¹⁷ Morris Kline, *Mathematics in Western Culture* (New York: Oxford University Press, 1953), p. 259.

¹⁸ Morris Kline, *Mathematics and the Physical World* (New York: Dover Publications, [1959] 1980), p. 441.

¹⁹ Oswald Spengler, “The Meaning of Numbers,” *The World of Mathematics*, ed. James R. Newman (New York: Simon and Schuster, 1956), 4:2335.

²⁰ Alistair C. Crombie, *The History of Science from Augustine to Galileo* (New York: Dover Publications, [1959, 1970, 1979] 1995), 1:25.

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skills. The initial European advantage lay in what French historians have called *mentalité* ... these people were thinking of reality in quantitative terms with greater consistency than any other members of their species.²¹

In 1925, before an audience at Harvard University, Alfred North Whitehead identified the “greatest contribution of medievalism to the formation of the scientific movement” as “the *inexpugnable belief* that every detailed occurrence can be correlated with its antecedents in a perfectly definite manner, exemplifying general principles. Without this belief, the incredible labours of these men would have been without hope.”²² To him, this conviction “must come from the medieval insistence on the rationality of God.”²³ This insistence implied that “Every detail was supervised and ordered: the search into nature could only result in the vindication of the *faith* in rationality.”²⁴ This was not the faith of a few isolated scientists, but of the whole of medieval European culture; a faith ingrained in a *broadly shared cultural matrix*. Whitehead confirms this analysis, “Remember that I am not talking of the explicit beliefs of a few individuals. What I mean is the impress on the European mind arising from the unquestioned faith of centuries. By this I mean the instinctive tone of thought and not a mere creed of words.”²⁵

It was the slow but certain maturation of a new corporate mental frame of reference, engendered by the progressive prospects acquired from the biblical view of linear time and an appreciation of a rational creation reflective of a rational, wise God who “hast ordered all things in measure, and number and weight” (Wisdom of Solomon 11:20-21),²⁶ that laid the foundation for an explosion in quantitative analysis. The basis for this change of *mentalité* is the New Testament revelation about *logos* and *monogenes*. This revelation, once embraced by an entire culture, eventually led to a full-flowering of mathematics, quantification, and scientific law (i.e., the foundational laws of motion).²⁷ This flowering, with many ups and downs (in terms of the interaction/compromise between the Christian Faith and neo-Platonism and later, Aristotelianism), took nearly a millennium to finally bear fruit; i.e., to *permeate* a culture and, as a result, Alfred Crosby documents the distinctive intellectual achievement of the West:

The record indicates that cycles of advance and retreat, in this case of combining abstract mathematics and practical measurement, and then of nodding and napping and forgetting, is the norm of human history. The West’s distinctive intellectual accomplishment was to bring mathematics and measurement together and to hold them to the task of making sense of a sensorially perceivable reality, which Westerners, in a flying leap of faith, assumed was temporally and spatially uniform and therefore susceptible to such examination.²⁸

²¹ Alfred W. Crosby, *The Measure of Reality: Quantification and Western Society, 1250-1600* (Cambridge: Cambridge University Press, 1997), pp. x-xi.

²² Alfred North Whitehead, *Science and the Modern World* (London: Free Association Books, [1926] 1985), p. 15 (emphasis added).

²³ *Ibid.* Stanley L. Jaki’s remarks are insightful, “Half a century has passed since these words startled a distinguished audience at Harvard University and indeed the whole intellectual world. The magnitude of the shock merely corresponded to the impenetrable density of a climate of opinion for which the alleged darkness of the Dark Ages represented one of the forever established pivotal truths of the ‘truly scientific’ interpretation of Western intellectual tradition.” See Stanley L. Jaki, *Science and Creation: From Eternal Cycles to an Oscillating Universe* (Edinburgh: Scottish Academic Press, 1986), p. 146.

²⁴ *Ibid.*, pp. 15-16 (emphasis added). Whitehead, however, maintains that the source of medieval belief in rationality is Greek philosophy. To him, a belief in God provided *only one thing* for the medievals; i.e., personal motivation. See *Ibid.*, pp. 19-20.

²⁵ *Ibid.*, p. 16.

²⁶ In Latin, “measure, number, and weight” is “*omnia in mensura, numero et pondere disposuisti*.” This phrase was the most often quoted and alluded to phrase in Medieval Latin texts. See E. R. Curtius, *European Literature and the Latin Middle Ages*, trans. W. R. Trask (London: Routledge and Kegan Paul, 1953), p. 504. See also Ivor Grattan-Guinness, *The Rainbow of Mathematics: A History of the Mathematical Sciences* (New York: W. W. Norton, [1997] 2000), p. 127.

²⁷ For the medieval roots of the inertial law of motion, see the ten-volume work by Pierre Duhem, *Le Système du monde: Histoire Des Doctrines Cosmologiques*, (Paris: Librairie Scientifique A. Hermann et fils, 1913-1959). For an abbreviated analysis in English, see Pierre Duhem, *Medieval Cosmology* (Chicago: University of Chicago Press, 1985). Additional help came from India and the Arabic culture: (1) Base 10 positional notation, (2) zero, and (3) a positive direction toward symbolic algebra.

²⁸ Crosby, p. 17.

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The philosophical presuppositions articulated by Scripture can be divided into three basic categories: (1) the view of nature and time (metaphysics), (2) the view of reason and experience (epistemology), and (3) the view of living (ethics).²⁹

Metaphysics

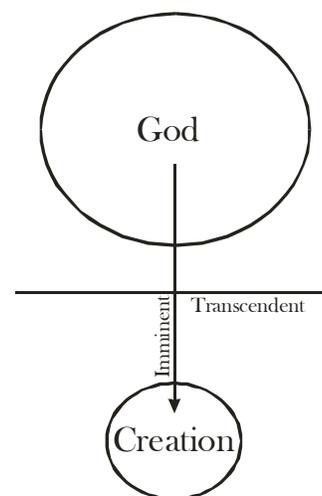
The New Testament built upon the revelation of the Old Testament. Like the philosophers of Ancient Greece, the Bible unfolds a unique (in history) understanding of the *nature* of nature, the *nature* of order, and the *nature* of time. First, contra to Greek philosophy, the Bible teaches a metaphysical dualism; i.e., a distinction and division exists between the uncreated Creator and the creation (cf. Genesis 1:1; Acts 17:24³⁰). Second, contra to Greek philosophy, the *logos* is not an immanent, impersonal force that brings order to the world. The *logos* is a transcendent *logos*; a living, eternal, and infinitely wise *person* of creative and sustaining power. The thrust of the first view verses of the Gospel of John would have shocked any reader steeped in Greek philosophy.

In the beginning was the Word (*logos*), and the Word (*logos*) was with God, and the Word (*logos*) was God, He was in the beginning with God. All things were made through Him, and without Him nothing was made. In Him was life, and the life was the light of men (John 1:1-4).

According to Scripture, the creation reflects harmonious order due to the decrees of a transcendent and personal Lawgiver who upholds and sustains all things by the word of His power (Hebrews 1:3). The createdness of all things in and through a person, the *Logos* of God, proved to be a certain assurance that all things cohere because of their Creator (Colossians 1:17), not in matter (contra the Stoics). All of the created order reflects a coherent wisdom because the *Logos* of God is also the Wisdom of God (Proverbs 8:12-36; I Corinthians 1:24; Colossians 2:3). Not only has the *logos* made the world, the *logos* has also entered the world taking on human flesh, the glory as of the only begotten (Greek: *monogenes*) of the Father (John 1:14-18) in order to save it (John 3:17). When the Apostle John chose to use *monogenes* as referent to the Incarnation, he challenged the fundamental metaphysical conviction of Greek philosophy: either Christ was the “only-begotten” or the universe was the “only-begotten.” In order to follow Christ, the only begotten of the Father, an educated Greek had to renounce the culturally pervasive concept the universe as the “Supreme Living Being.” He had to reject animistic pantheism. The prologue of John (i.e., John 1:1-18) de-divinized *and* de-animized the Greek understanding of the universe.

Athanasius (ca. 293-373) stood *contra mundum* (against the world) of Arian heresy (that purported Christ as not being fully God). In this context, he recognized the significance of a *fully* rational and wise God creating a fully rational and good (interconnected and interacting) creation.³¹ After citing John 1:1, Athanasius described the universe as a divine hymn:

For just as though some musician, having tuned a lyre, and by his art adjusted the high notes to the low, and the intermediate notes to the rest, were to produce a single tune as the result, so also the Wisdom of God,



²⁹ Of course, none of the following distinctives have been consistently held throughout the history of Christendom. In spite of that, key leaders in the early church like Athenagoras, Tertullian, Athanasius, Basil of Caesarea, John Philoponus, John of Damascus passed on fundamental insights, especially the doctrine of creation (they celebrated Christ as the chief choir leader, the *choregos* of creation), to late Islamic and medieval Christian thinkers (e.g., Thomas Bradwardine, John Buridan, Henry of Langenstein, Nicholas of Cusa, and Nicole Oresme). The 19th century quest for a unification of electricity, magnetism, and optics, culminated by the work of James Clerk Maxwell, was still inspired by these theological ideals. Today, TOE (Theory of Everything) and string theory (the attempted unification of Einstein’s theory of relativity and quantum mechanics) are aspirations that reflect a vestige of this same quest (without Christocentric foundations).

³⁰ Note that some of the listeners in Paul’s audience at Athens were Epicurean and Stoic philosophers (who believed that *matter* was the universal glue binding all things together).

³¹ Athanasius recognized that if the errors of Arianism were not nipped in the bud, Christianity would devolve into Greek pantheism.

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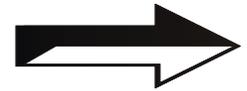
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handling the Universe as a lyre, and adjusting things in the air to things on the earth, and things in the heaven to things in the air, and combining parts into wholes and moving them all by His beck and will, produces well and fittingly, as the result, the unity of the universe and of its order ... He produces as the result a marvelous and truly divine harmony.³²

The divine harmony of Athanasius differs antithetically (at the root level) with the Pythagorean “harmony of the spheres.” To Pythagoras (ca. 582-ca. 500 BC) and the rest of the pantheon of Greek philosophers, this harmony was not the reflection of a personal, rational Creator revealed in the flesh as the only-begotten Son of God. Although Athanasius was *contra mundum* (against the world of error), he was *pro universo* (for the universe). He was *pro universo* because to him Christ holds the universe together in His wisdom and by His power. It is this revelation of Christ, God made flesh, that is the *only* valid ground for a totally rational and harmonious universe, an orchestral hymn linking the realm of the celestial with the realm of the terrestrial. Contra Aristotle, who denied that any coherent law could unite these two realms, the Christian West, founded upon the reality of the Incarnation of Christ, could embrace such a union. And it eventually did in the person of Isaac Newton (1642-1727) for he breathed deeply of such a Christian consensus, in spite of his own latent Arianism, in an English scientific atmosphere commanded by Puritan theology. This “air of truth” provided the foundation for Newton’s confidence that he could connect the falling of an apple with the motion of the moon. He made this connection mathematically in his inverse-square law,³³ better known as the law of *universal* gravitation (one law connecting two diverse realms, motion celestial with motion terrestrial).

One of the major arguments that Augustine (354-430) constructed in *City of God* was that time is linear (i.e., it has a beginning and an end). Contra to the cultural pessimism engendered by the Greek belief in cyclical time, linear time provided an impetus for progress, growth, and development. In the words of science historian Stanley L. Jaki (1924-):



Augustine’s *City of God* molded more than any other book by a Christian author the spirit of the Middle Ages. Its pages were as many wellsprings of information and inspiration for the emerging new world of Europe about the meaning of mankind’s journey through time. He declared that the physical universe and human history both had their origin in the sovereign creative act of God, which also established a most specific course and destiny for both.... This book became the intellectual vehicle for a confidence which centuries later made possible the emergence for the first time of a culture with a built-in force of self-sustaining progress.³⁴

Epistemology

Scripture reveals man as a rational being capable of perceptive and reflective thinking. Contra the Greeks, the Bible teaches that God’s revelation, not the human mind, is the foundation of reason and knowledge. God’s communicative word (i.e., *logos*) is not to be placed at the tribunal of human reason; human reason is always at the tribunal of God’s communicative word. Therefore, the mind of man is not autonomous; it is a *tool* to be used in dependence

³² Athanasius, *Against the Heathen* (Albany, OR: Sage Digital Library, 1996), 42. See 39-41 for citational context. It has taken science seventeen centuries to confirm the analysis of Athanasius, i.e., that the universe is indeed a stunning complex of carefully coordinated factors. Arius (d. 336), the theological combatant of Athanasius was a monotheist, not a Trinitarian. His thinking was also tied to the Stoic cosmology that included, due to its cyclical nature, a universe that periodically destroyed itself. This view of the cosmos could hardly engender the composition of a “hymn of harmony.”

³³ Written mathematically as $F = Gm_1m_2/D^2$ where m_1 and m_2 represent the mass of two objects, D is the distance between these objects, G is a gravitational constant, and F is the force of gravitational “pull” between the two objects. If $m_1 =$ your mass and $m_2 =$ the mass of the Earth, then $F =$ your weight (i.e., the measure of the gravitational “pull” between you and the Earth).

³⁴ Jaki, *Science and Creation: From Eternal Cycles to an Oscillating Universe*, pp. 177-178.

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upon a higher authority who knows all things exhaustively; i.e., the foundation for understanding lies *outside* of man (cf. Proverbs 1:7, Proverbs 9:10; Psalm 36:9; Colossians 2:3). When Kurt Gödel (1906-1978) developed his Incompleteness Theorems in 1931, he showed, through a brilliantly reasoned discourse,³⁵ that neither rationalism (e.g., intuitionism, logicism, formalism) nor empiricism (e.g., logical positivism) *in themselves* can produce a consistent and non-contradictory system of thought (specifically, in reference to axiomatic foundations of number theory). His analysis has led sensitive thinkers to the conclusion that the foundation for knowledge resides outside the reach of man's wholly rationalistic capabilities. For example, Stanley L. Jaki reflects:

For one thing, Gödel's theorem casts light on the immense superiority of the human brain over such of its products as the most advanced forms of computers. Clearly, none of these machines can ever yield an answer comparable in its breadth and depth to Gödel's theorem. For another, despair can grow only in a soil where a rigid rationalism has already killed off the seeds of intellectual humility. Such a soil cannot nurture the recognition that there is no escape from admitting that in mathematics and *a fortiori* in physics certainty is not the fruit of a "pure rationalistic" procedure alone.³⁶

In the realm of knowledge about this world, the *a priori* and *a posteriori* are equally ultimate and must be kept in perfect balance (e.g., what Isaac Newton attempted to do). Newton never said that his conclusions were absolute (although his heirs tended to do so). He said, "This most beautiful system of sun, planets, and comets could only proceed from the counsel and dominion of an intelligent and powerful Being.... This Being governs all things, not as the Soul of the world [contra Greek perceptions of the universe - JN], but as Lord over all."³⁷ It is God who therefore teaches man knowledge (Job 36:22; cf. John 1:9), whether man accepts this ultimate source or not, both through the gift of an ordered and coherent external world (*a posteriori*) and through the gift of man's reason (*a priori*). The mind of man, with its intuitive, rational, and mathematical capabilities, and the objective world, with its mathematical properties, cohere because of a common Creator.

Ethics

Like knowledge, there are objective standards for ethics that lie outside of man (i.e., man is not the determiner of what is right and what is wrong). These standards are like rails for a train; without them, the train is headed for serious trouble. Contrast absolute standards with the constantly changing standards, based upon the whims of society (i.e., 51% vote) and the individual, of moral relativism. The Bible teaches that "trust in man" is futile and vain (Jeremiah 17:5-6, 9; Ecclesiastes). The good life is not the contemplative life of Pythagoras or Epicurus; it is the obedient life. The good life is the life that joyfully recognize the futility of self-trust (either in reason or in experiences). The good life is not the life of establishing self-imposed standards of ethics (which are as futile as anyone else's self-imposed standards). The good life is to gladly submit one's *mentalité* to One infinitely wiser and knowledgeable (Jeremiah 17:7-8).

In summary, these networked categories of thinking and living (metaphysics, epistemology, and ethics) played a distinctive role in the rise of modern science (with its attendant explosion in mathematical knowledge, especially in its revelation of the ordered patterns, i.e., laws, of the cosmos). According to Reijer Hooykaas (1906-1994), professor of History and Science at the University of Utrecht, the Netherlands:

For the building materials of Science (logic, mathematics, the beginning of a rational interpretation of the world) we have to look to the Greeks; but the vitamins indispensable for a healthy growth came from the biblical concept of creation. The fact that the victory of Christianity did not bring an immediate liberation from the bonds of Greek metaphysics in no way disproves this statement. The compromise of Christian re-

³⁵ It is amazing to realize that Gödel used reason to show that reason was insufficient as an epistemological base.

³⁶ Jaki, *The Relevance of Physics*, pp. 129-130.

³⁷ Isaac Newton, *The Principia*, Andrew Motte, trans. (Amherst: Prometheus Books, [1848] 1995), p. 440.

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ligion, first with Platonism, then with Aristotelianism, strongly influenced not only secular learning but also theology.³⁸

The biblical view of nature, time, and history gave the 16th to 18th century scientists the conviction, inexpugnable belief, faith, and confidence to pursue the course of taking dominion over the physical world through the development of quantitative laws. According to English philosopher Robin G. Collingwood (1889-1943), “The possibility of an applied mathematics is an expression, in terms of natural science, of the Christian belief that nature is the creation of an omnipotent God.”³⁹ Alfred North Whitehead remarked that “the mathematics, which now emerged into prominence, was a very different science from the mathematics of the earlier epoch.”⁴⁰ As Morris Kline observes, “The consequences for mathematics was a burst of activity and original creation that was the most prolific in its history.”⁴¹

³⁸ Reijer Hooykaas, *Religion and the Rise of Modern Science* (Grand Rapids: Eerdmans, 1972), p. 85.

³⁹ Robin G. Collingwood, *An Essay on Metaphysics* (London: Oxford University Press, 1940), p. 253.

⁴⁰ Whitehead, *Science and the Modern World*, p. 38.

⁴¹ Kline, *Mathematical Thought from Ancient to Modern Times*, p. 230.