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MIND, METAPHOR, AND SCIENCE

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ABSTRACT

Metaphor is the language of the gods. It is the connecting link between the brain (organ) and the mind (thought). To think is to think metaphorically. Mind and metaphor are simply two different names for one and the same thing. All of the various academic disciplines-philosophy, psychology, and science-are the robust children of one or two root metaphors. The following root metaphors-mechanism, organism, and mind-have been instrumental in helping to shape not only western philosophy but also in fashioning the theory and practice of modern science.

Key words:

Mind, metaphor, root metaphor,
philosophy, psychology, science,

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INTRODUCTION

Paul tells us: "For now we see through a glass, darkly" (1 Corinthians, 13:12, KJV). What a powerful metaphor. Plato, Kant, Bruner, and Wheeler would all endorse its truth. The mind does not encounter the world in a face-to-face fashion. Sense data is always processed through a mind already organized around a collection of powerful metaphors. Consider the following syllogism: All thought is symbolic; all symbolism is metaphorical; therefore, all thought is metaphorical. If the two premises are true, then the conclusion must also be true. The first premise is a self-evident truth. How could it be otherwise? There is no entrance into the mind except through symbolism. This is true for any and all mental images-ideas, pictures, diagrams, mathematics, scientific theories-everything has to be transformed into symbols by the mind.

A metaphor is created whenever one thing is spoken of as if it were another. The word "dog" stands for the four legged, barking creature who greets you at the front door. This is equally true when it comes to designing a house. House plans are metaphors whose details are expressed in the language of numbers. How heavy a load can a wooden 4x12 carry? When I was building my present house, workers would come to me and ask: "Where are your plans?" The answer was always the same, "Inside my head." Tell me what you wish to know, and I will draw you a picture. A house, like everything else in life, begins as a simple metaphor.

All thought-science, history, religion, mathematics-begins and ends with metaphor. Remember the first time you learned

about "imaginary" numbers? I was a grown adult before I discovered such a thing. There is no "real" number expressing the answer to the problem of the square root of a -1, thus the system of "imaginary" numbers. The answer to the problem is expressed by the letter "i". Can you think of a bigger mental fiction or metaphor?

Where does the ability to create metaphor come from? Winner *et al.* (1979) contends there is "growing evidence that even infants have incipient categories . . . and that children at the very early stages of language acquisition are able to respect the sort of semantic rules that are violated in metaphoric language" (p. 30). Metaphor abounds in the arts and sciences. Metaphor can be found, Gardner (1982) tells us, at the "highest reaches of creativity, where someone is articulating a scientific theory or describing a subtle mood" (pp. 166-167).

The ability to compose metaphor, however, does not fit well into Gardner's Theory of Multiple Intelligences. Metaphor, by its very nature, cuts across domains. "In fact," says Gardner (1993), "this family of capacities seems at odds with the whole notion of separate intelligences, for the metaphoric intelligence (if we may so tentatively label this set of capacities), is defined by the very capacity to integrate diverse intelligences" (p. 290).

The whole fabric of the human mind is woven together by metaphors. The mind does not construct knowledge without employing metaphors. Kant's (1781/1958) *Critique of Pure Reason* offered us an insightful theory of knowledge. Kant made a fundamental distinction between phenomena and noumena. Phenomena are those sense experiences flowing to us from the external world. The mind acts upon these experiences and turns them into knowledge. Noumena, on the other hand, are what Kant called things in themselves. "The concept of a noumenon is necessary, to prevent sensible

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intuition from being extended to things in themselves, and thus to limit the objective validity of sensible knowledge” (p. 155). What, for example, is the nature of light? We do not know what light is in and of itself. We can only experience it as a wave or a set of particles. Humans are locked into viewing the external world as “though a glass, darkly.”

All thought is rooted in a limited number of metaphors. Pepper (1972) presents a persuasive case for how root metaphors mold thinking. There is a simple root metaphor-mechanism, organism, or mind-lying at the heart of every intellectual system. “A world hypothesis is determined by its root metaphor” (p. 96). Root metaphors are useful tools for analyzing abstract systems of thought. They act as keys for “unlocking the doors to those cognitive closets which constitute the literature of structural hypotheses in philosophy and science” (p. 149). Identifying root metaphors is an essential step in becoming a reflective thinker.

The purpose of the following article is to illustrate how three root metaphors-mechanism, organism, and mind-have shaped the thinking of three principal philosophies-realism, naturalism, and idealism or mind. Mechanism, the first root metaphor, has historically supported the philosophy of realism, which had a profound effect on Newton and the Enlightenment. From La Mettrie’s *Man the Machine* to Smith’s *Wealth of Nations*, realism ruled the day. Organism, the second root metaphor, has attracted the attention of the naturalist school of philosophy. Darwin’s theory of evolution was a direct outgrowth of his organic metaphor and naturalistic philosophy. Spencer’s *Synthetic Philosophy* borrowed Darwin’s theory of evolution and turned it into a unifying principle for all the sciences. Mind is the third root metaphor. It has supported the philosophy of idealism. Wheeler, taking his cue from quantum physics, believes we live in a participatory universe. Reality requires a human witness.

In addition to the three principal philosophies, three composite or secondary philosophies have emerged. These philosophies are composed of two of the root metaphors. Cyborgism, which is the first composite philosophy, combines realism and naturalism. A cyborg, if science is ever successful in creating such a person, would be part machine and part living tissue. Markham’s Human Brain Project, if it were completed, would be a giant step in the direction of a conscious, thinking machine. Romanticism constitutes the second composite philosophy, linking naturalism and idealism. Rousseau served as the spiritual godfather for the movement, which had a profound effect on literature and the arts in the 19th century. Rousseau’s *Emile* stimulated the progressive education movement in the 20th century. Dualism is the third composite philosophy-fusing together realism and idealism. Descartes is noted for his contribution to a dualistic conception of human nature. A person is made up of a machine like body and a spiritual mind. Much of western thought has revolved around these three composite philosophies.

Model of Mind

Principal philosophies

Mechanism

Philosophy. The mechanistic metaphor underscores the philosophy of realism. Realists believe our senses inform us about a real world external to ourselves. Atoms, planets, and

stars are all real; they are not figments of our imaginations. A real world of things exists whether we choose to recognize it or not. Realists contend the most significant feature of the universe is its permanence. The mind, metaphorically, operates like a camera, taking pictures of the world. When we have an accurate picture of reality, we can talk about knowing the truth.

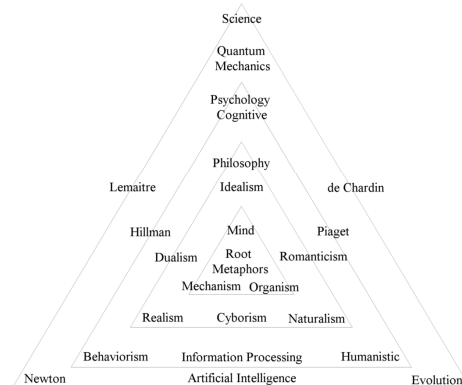
Realism has had a distinguished and scholarly history. Some of the world’s greatest thinkers have been realists. John Locke, David Hume, and Gilbert Ryle were all realists. Ryle’s book, *The Concept of Mind*, has become a modern-day classic. Ryle has taken exception to Descartes’ mind-body dualism. Ryle contends that Descartes dualism is rooted in a misunderstanding of such mental states as willing, thinking, and imagining. Language tricks us into believing mind is an extraordinary substance controlling the body. Ryle refers to this belief as “the dogma of the ghost in the machine” (pp. 15-16). Mental constructs, properly understood, do not refer to ghostly acts but to dispositions to behave in certain ways. The whole dualist problem comes down to a category mistake, which occurs when we represent “the facts of mental life as if they belonged to one logical type of category (or range of types of categories), when they actually belong to another” (p. 16).

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Model of Mind

Figure 1



Psychology. J. B. Watson, who was the founder of behaviorism, constructed his psychology on a mechanistic metaphor. Watson (1913) asserted: “Psychology as the behaviorist views it is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior” (p. 158). There is no need to speculate about what is going on inside someone’s head. Thinking is merely talking to our selves. The analysis of behavior is all that is necessary to predict someone’s actions. Watson was greatly impressed by the research conducted by Bekterev and Pavlov on dogs. He became convinced that conditioned reflexes lay at the heart of all learning.

Thorndike had a profound influence on education psychology during the first half of the 20th century. He was one of the pioneers who helped to promote the idea that psychology forms the cornerstone of a scientific education. Thorndike believed the scientific method could be applied to a wide

variety of human problems. At the heart of Thorndike's scientific faith was the assumption that whatever exists, exists in quantity and therefore can be measured. He spent a good part of his life constructing tests to measure everything from personality to intelligence. Thorndike (1903) was fond of saying: "We conquer the facts of nature when we observe and experiment upon them. When we measure them we have made them our servants" (p. 164).

Watson's and Thorndike's dreams of a scientific psychology came to fruition in the hands of B. F. Skinner, who regarded behaviorism as a special case in the philosophy of science. Science can lead us to a better, more peaceful world-one where planned communities are populated by planned people. "We need not worry about the scientific way of life," Skinner (1967) assures us, "it will take care of itself" (p. 412). Skinner's principal contribution to psychology was his theory of operant conditioning. Most behavior, he contends, is operant-responses emitted by the organism as it acts upon the environment. An operant is the kind of behavior an organism naturally tends to emit. Cats scratch, dogs bark, and men watch football on Sunday afternoons. The term operant, Skinner (1953) informs us, "Emphasizes the fact that the behavior operates on the environment to generate consequences" (p. 65). The success of operant conditioning is contingent upon how a response is reinforced. Reinforcement may come from a wide variety of different sources. Cell phones, for instance, are programmed by manufactures to reinforce people's behavior through eye-catching images or little beeps, which have the effect of causing people to keep their phones working 24 hours a day.

Science. Newton is the primary architect who gave us a mechanistic metaphor for reality. The Law of Gravity became the central construct around which Newton organized his theory. Newton viewed the cosmos as a three-dimensional, closed system in which all of the heavenly bodies, through the workings of gravity, checked and balanced one another's movements. "Newton's universe," says Kaku (2006) "was like a gigantic clock wound up at the beginning of time by God which has been ticking away ever since" (p. 26). Space, time, and matter were all separate entities. Space and time were absolute. Time flowed uniformly from the past, through the present, and into the future. A rigid determinism was implicit in Newton's cosmos. All events followed necessarily from natural law. To measure these occurrences, Newton developed the calculus. "Newton's method," says Jones (1982), "even more than his deciphering the planetary order, is the intellectual legacy of the Enlightenment. And at the core of this method is its mathematical predictive capacity" (p. 36).

Newton's physics had a profound effect upon the thought of the 18th century Enlightenment. Three of the prominent thinkers-Montesquieu, Smith, and La Mettrie-formulated mechanistic metaphors that have lasted to this day. Montesquieu wrote an influential book, *Spirit of the Laws*, in which he outlined the three distinct cogs or branches of government. To prevent the rise of tyranny, executive, legislative, and judicial branches were designed to check and balance one another. Many of the Founding Fathers who wrote the Constitution had read Montesquieu, and they built his ideas into American government. The appeal of Adam Smith's book, *Wealth of Nations*, has also been long standing. Smith looked at the economy as following natural laws of supply and demand. If each nation produced what it could produce best, and if there were free trade among all nations, then the whole

economic machine would balance itself in the best interest of everyone. The doctrine of laissez-faire economics, which grew out of Smith's thinking, captured the imagination of American capitalists. Though two-and-a-half centuries old, it still finds adherents among the Republican Party. If the whole of the world is a machine, then it is not too much of a stretch of the imagination to see humans as being complex machines. In his book, *Man the Machine*, La Mettrie does exactly that (Brinton, 1965, p. 291). Not only is the body a machine, but in 21st century thought the brain itself is viewed as a complex computer. Thinking is merely the running of a software program.

Einstein turned Newton's common sense universe on its head. Space and time became fused together. Gravity, Newton's great achievement, was explained as the result of planets and stars leaving indentations on the fabric of spacetime. Both Newton and Einstein were devoted realists, believing in a deterministic universe. All events are determined by natural laws. Freedom of will is an illusion. Kaku (2006) cites Einstein as saying: "I am a determinist, compelled to act as if free will existed, because if I wish to live in a civilized society, I must act responsibly" (p. 154).

Einstein rejected Heisenberg's interpretation of quantum phenomena, saying: "God doesn't play dice with the universe" (Boslough, 1989, p. 35). Kaku (2006) informs us that quantum mechanics and general relativity have left us with two very different pictures of reality. "One for the bizarre subatomic world, where electrons can seemingly be in two places at the same time, and the other for the macroscopic world that we live in, which appears to obey the common sense laws of Newton" (pp. 155-156). If reality and truth are one, which view are we to choose?

Organism

Philosophy. One of the strangest events in American history took place in Colonial New England, the Salem witch trials. The colonists of Salem decided their colony had been invaded by witches. They set out to rid themselves of this menace. A goodly number of colonists were tried and put to death. The colonial mind saw supernatural forces-God, Satan, and witches-at work everywhere in the world. The rationalism of the 18th century put a serious dent in the belief in divine intervention. The world was becoming a more secular place. By the time the 19th century rolled around, naturalism had become the liberating idea of the day. Naturalism simply asserts that nature is all that there is. Gods and demons are nothing more than primitive superstitions. Humans are as much a part of the natural order of things as are dogs and fleas. There is no need to endow people with immortal souls.

Herbert Spencer was among the 19th century intellectuals who helped to lay a firm foundation for naturalism. Indeed, says Parsons (1959), "Spencer's influence and prestige in America during the late nineteenth century was so great that it is difficult to sketch the history of American thought during that time without noticing his leading ideas" (p. 225). Spencer's naturalism became linked with Darwin's evolution. Both thinkers based their ideas on an organic metaphor. Society, Spencer concluded, was like a living organism, which evolved as it developed more specialized functions. Spencer made evolution the unifying theme running through his *Synthetic Philosophy*, which set out to unify all knowledge coming from the different sciences. Spencer's essay, "What knowledge is of most worth?" also celebrated the importance of science. All

basic human activities-self-preservation, sustenance, reproduction, social organization, and even art and leisure time-were best accomplished through the workings of science (Spencer, 1969, p. 291).

Psychology. Humanistic psychology grew out of an organic metaphor. It arose as a reaction against the reductionism of behaviorism, which wished to explain all human actions in terms of overt behavior. Humanism, on the other hand, desired to peek inside the head and heart in order to explain human behavior. Two psychologists, Rogers and Maslow, were among the principal architects of the movement. Both Rogers and Maslow agreed that human nature was basically good; that infants were endowed with great potentials; that individuals should discover who they happened to be on the inside; and that psychology represented as a useful tool to build a better social order.

Carl Rogers (1967) was the central figure credited with having created non-directive or client-centered psychotherapy. "It is the client who knows what hurts, what direction to go, what problems are crucial, what experiences have been deeply buried" (p. 359). Healing flows out of the client. The therapist's role is merely one of facilitating the client's self-exploration. The insights gained from psychotherapy belong to the client, not to the therapist. Rogers (1979) believed each individual person represented a self-regulating system. Everyone, if given an opportunity, would select experiences contributing to his or her personal growth. "The individual has within him or herself vast resources for self-understanding, for altering the self-concept" (p. 98). Rogers (1983) promoted the dictum: Be mentally healthy and follow your feelings. The well-adjusted person "would do what 'felt right' in this immediate moment, and he would find this in general to be a competent and trustworthy guide to his behavior" (p. 288).

Abraham Maslow's genius was one of borrowing Aristotle's philosophy and building it into American psychology. Aristotle's use of an organic metaphor to describe how all living things move from their potentiality to their actuality became the central focus of Maslow's psychology. Maslow (1959) tells us that "man demonstrates in his own nature a pressure toward fuller and fuller Being, more and more perfect actualization of his humanness in exactly the same naturalistic, scientific sense that an acorn may be said to be 'pressing toward' being an oak tree" (p. 130). Humans, right from the beginning of life, demonstrate great potentials. A baby, Maslow (1972) informs us, "has vast potentials and therefore, in a certain sense, is anything" (p. 116).

Maslow (1972) reflected Aristotle teleological principle when he tells us each person should develop his or her potentials to the "fullest height that the human species can stand up to or that the particular individual can come to" (p. 169). Finally, Aristotle arranged the whole of being into a hierarchy, capped by reason and an appreciation of beauty. Maslow's Hierarchy of Needs showed a clear Aristotelian influence. People move from the satisfaction of physical needs, through self-actualization, and on to knowing and appreciating beauty. Humans, Maslow (1954) informs us, have an impulse "to satisfy curiosity, to know, to explain, and to understand" (p. 97). They also have "a truly basic aesthetic need" (p. 97). Thus rationality and aesthetics form the apex of the pyramid.

Science. The organic metaphor has become an integral part of the biological sciences. The best known spokesman for the position was Charles Darwin. Darwin's masterwork, *The Origin of Species*, has been both heralded as a mind liberating idea as well as condemned as a secular heresy. The word Darwinism has become a metaphor in its own right. Evolution replaced the story of divine creation with one featuring the slow process of natural selection. Darwin discovered in Malthus' essay, *On Populations*, the motor mechanism necessary to make his theory work. The food supply, Malthus argued, increases arithmetically; the birth rate, on the other hand, increases geometrically. Thus there is a pressure on the land. Only the fittest are those who survive. The "eat or be eaten" doctrine was really the work of Darwin's interpreters such as Spencer and Huxley. Darwin was more inclined to view social cooperation as the critical factor in human survival (Sagan, 1980, pp. 27-29).

Evolution has not only given rise to the human species, but it has served as the architect for the most complex organ in the world, the human brain. Paul Maclean, building on comparative anatomy, has formulated a triune brain theory. The human brain, it turns out, is really three brains in one. The newer brains are folded around the older ones. Each brain has retained traces of behaviors that were characteristic of earlier species. The oldest brain is the reptilian or R-complex. It is composed of the spinal cord, medulla and pons. The reptilian brain contains the neural information necessary for reproduction and self-preservation. Aggression, territoriality, ritualistic displays, and established hierarchies are among the characteristics of reptilian behavior. Wrapped around the reptilian brain is the mammalian brain or limbic system. Humans share with other mammals the emotions of fear, anxiety, altruism, and love. The ability to remember is also housed in the mammalian brain. Finally, seated on top of the other two brains is the neocortex. Though other primates share in some of this brain tissue, none possess the storehouse made available to humans. The neocortex makes language, culture, and abstract thinking possible. All the traits we think of as distinctly human are features of the most recent evolutionary addition to our brains (Sagan, 1977, pp. 53-83).

Evolution is not merely a terrestrial phenomenon. It is a unifying principle underlying the construction of the cosmos. From the moment of the big bang-through the formation of stars and galaxies to the present-day expansion of the cosmos itself-evolution has been hard at work. Wakker and Richter (2004) contend that the Milky Way, far from being an inert relic from the distant past, is really a dynamic, living entity. "The Milky Way is not a finished work but rather a body that is still forming" (p. 40). Evidence of the continuing growth of the Milky Way comes in the form of high-velocity clouds of hydrogen moving through the outer regions of the galaxy. These clouds of gas "show that the galaxy is breathing-pushing out gas and then pulling it back in, as if exhaling and inhaling" (p. 40). The high-velocity gas suggests that a large "sphere of hot, tenuous plasma surrounds the galaxy" (p. 40). All the new evidence suggests we are living in a galaxy that is still evolving (pp. 38-47).

Mind

Philosophy. Whitehead (1927/1957) once remarked, "The safest general characterization of the European philosophical tradition is that it consists of a series of footnotes to Plato" (p.

53). Plato (380 BC/1968) was the founder of the philosophical school of thought known as idealism, which rests squarely on the root metaphor of mind. Idealists hold that the world we experience with our senses is merely one of appearances. Reality lies behind these appearances; it is composed of idea, Form, spirit, or mind. The key to Plato's metaphysics is contained in his parable of the cave. Plato asks us to imagine a group of prisoners who are chained by the neck and the leg inside a dark cave. All they have ever seen are dancing shadows on the wall, which are being cast by a fire outside the cave. One day, a prisoner escapes from the cave and emerges into the light of day. At first the prisoner is blinded by the brilliance of the newly discovered world. In time the prisoner comes to see things as they really are. The story of the prisoner is symbolic of the journey of the soul as it seeks to know the absolute Forms (pp. 227-231).

Berkeley and Kant were two of the seminal figures in the development of modern idealism. Berkeley left us with the pithy, little proposition: "To be is to be perceived" (Wheeler, 1994, p. 120). Objects and events cannot be said to exist apart from their being perceived by some conscious mind. Kant was one of the truly great thinkers in western philosophy. In his theory of knowledge, he made a distinction between "noumena" and "phenomena." "Noumena" are things in themselves; "phenomena" are things humans are able to experience through their senses. Mankind can only acquire knowledge of those things that can be experienced. Sense data does not come complete with its own categories of organization. Systems of classification are imposed upon experience by the creative activity of mind.

Experimental science, when it emerged into the modern world, aligned itself with realism. Newton's physics favored such an alliance. Idealism became a backroom theory kept alive by philosophers. This picture, however, has begun to change. The problems encountered by quantum physics and big bang theory suggest that Plato's philosophy deserves a second look. Afshordi, Mann, and Pourhasan (2014) contend that, "Plato was on to something. We may all be living in a giant cosmic cave, created in the very first moments of existence" (p. 38). The three physicists argue that, "This three-dimensional universe is merely the shadow of a world with *four* spatial dimensions" (p. 38). Our three-dimensional universe may be nothing more than a shell around a *four*-dimensional black hole. New questions, never entertained by Newton, have emerged. "What are dark matter and dark energy, and why do they make up 25 and 70 percent of the universe, respectively" (p. 40)? No one seems to know the answer to these questions. The authors conclude by suggesting that if we assume a holographic model for the big bang, it "resolves not only the main puzzles of uniformity and near flatness of standard cosmology without resorting to inflation but also nullifies the damaging effects of the initial singularity" (p. 43). If the universe is merely a hologram, then clearly we are back inside Plato's cave.

Psychology. Jerome S. Bruner was a cognitive psychologist who believed mind is clearly the measure of all things. His psychology is more than a little reminiscent of the philosophy of Plato and Kant. Knowledge, Bruner (1979) contends, is a model we construct in our heads in order to give meaning and regularity to experience. Reality is never experienced face-to-face. The "real" is always filtered through a mind already programmed with organizing ideas. "We invent concepts such as force in physics, the bond in chemistry, motives in

psychology, style in literature as means to the end of comprehension" (120). Mind uses a variety of prosthetic devices as tools for thought. Among these, Bruner (1971) tells us, "are pictorial and diagrammatic conventions as well, theories, myths, modes of reckoning and ordering" (p. 7). Intellectual models are our guiding metaphors, devices for condensing and refining experience. Models permit us to predict and regulate the world around us. "We do the greater part of our work by manipulating our representations or models of reality rather than by acting directly on the world itself" (p. 7).

Bruner (1965) asserted that knowledge has structure. Each academic discipline is composed of a handful of basic ideas that provide the guiding principles around which its body of knowledge is organized. "The basic ideas that lie at the heart of all science and mathematics and the basic themes that give form to life and literature are as simple as they are powerful" (pp. 12-13). Basic ideas permit us to condense factual information into generalized principles. The interesting thing about human perception is not that our senses tell us so much but that they tell us so little. Mind has the capacity for extrapolating a great deal of information from a few scraps of sense data. Humans are not only able to deal with the information at hand, but they are able to go far beyond the evidence given. "The testimony of the senses," says Bruner (1983), "seems less like primary stuff of knowledge than like fodder for testing hypotheses that precede sense data" (p. 66). Mind possesses its own rational powers for sorting and classifying experiences, thus turning physical stimuli into knowledge.

Science. Schrodinger's equation for wave function contradicts one of the hallmarks of western philosophy, Aristotelian logic. According to Aristotle, everything has an essence-its absolute identity card. An entity cannot be both **A** and **non-A** at one and the same time. A photon cannot be a wave and a non-wave simultaneously. A non-Aristotelian conclusion is written into Schrodinger's equation. Experiments confirm, says Horgen (1992), "photons, neutrons, and even whole atoms act sometimes like waves, sometimes like particles, but they actually have no definite form until they are measured" (p. 76). Not only are atomic particles hard to define, but "measurement of one quantum entity can instantaneously influence another far away" (p. 96). This odd behavior can occur not only in the microscopic realm but even objects large enough to be seen by the naked eye. No wonder Einstein said: "if quantum mechanics is right, then the world is crazy" (Hogan, 1992, p. 96).

John Wheeler (1994) was one of the principal architects of the quantum world in which we find ourselves. He not only coined the term "black hole," but he placed human intelligence at the center of the cosmos. Quantum physics, Wheeler tells us, destroys the concept of a world as separate from human investigators. Even in the act of observing a simple electron, the observer must install the measuring equipment. What will the equipment measure, position or momentum? To measure one is to exclude the other. The act of measuring inevitably changes the state of the electron. The universe will never be quite the same. To truly describe what has happened, it is necessary to leave behind the old word "observer" and to replace it with the new word "participator." "In some strange sense," says Wheeler (1994), "this is a participatory universe" (p. 25).

Wheeler views mind as an active force in helping to create the universe. The mind's reality-making powers can transcend time, allowing an experimenter to alter events that occurred in the past. Tegmark and Wheeler (2001) describe a delayed choice experiment in which "not only can a photon be in two places at once, but experimenters can choose, after the fact, whether the photon was in both places or just one" (p. 72).

Composite philosophies

Realism, naturalism, and idealism are all major metaphysical schools of thought. In addition to these philosophies, three composite philosophies have evolved over time. (See Figure 1.) These philosophies-cyborgism, Romanticism, and dualism-combine two of the root metaphors. Cyborgism represents a synthesis of realism and naturalism. A Cyborg is a person who possesses both mechanical and biological attributes. Computer chips are found everywhere in today's world. Many people would be lost without their cell-phones or I-pads. GPS is the universal traffic cop. Romanticism combines naturalism and idealism. Many thought-provoking ideas have grown out of this synthesis. Romanticism became a major theme in 19th century literature. It had an equally profound affect on progressive education, which experienced great popularity between the two world wars. Finally, dualism is a way of believing in realism and idealism at one and the same time. Humans are a prime example of a walking and talking dualist reality. People are said to have an immortal soul (idealism) and a physical body (realism). Most Christians readily accept dualism as part of their theology.

Cyborgism

Philosophy. Mankind stands on the threshold of a new era-the fusion of genes, culture, and technology. In the past, humanity was the prisoner of evolution. Change came about very slowly. All of that has now changed. Through technology, humanity can take charge of its own evolution. Max (2017) tells us that, "Technology now does much of the work and does it far faster, bolstering our physical skills, deepening our intellectual range, and allowing us to expand into new and more challenging environments" (p. 49). To illustrate his point, Max (2017) reports on a man who is thought to be the world's first official cyborg. Neil Harbisson was born with a rare condition known as achromatopsia, which prevented him from seeing color. He lived in a black and white world. Harbisson had an electronic device implanted in his skull that allowed him to, through the use of sound, discover color. A fiber-optic sensor picks up the color in front of him and a microchip implanted in his skull converts those frequencies into vibrations on the back of his head. The sound frequencies turn his skull into a third ear. To make the whole system work, Harbisson has an antenna coming out of the back of his head. Harbisson says the input has begun to feel neither like sight nor hearing but a sixth sense (pp. 42-63).

Psychology. Robert Gagne was an American psychologist who began his career as a behaviorist, but he moved progressively throughout his career in the direction of information processing. Gagne tried to unify the many different strands of learning theory into one comprehensive system. Gagne used a computer metaphor for thinking about how humans learn. The flow of information through the nervous system is analogous to the movement of an electrical current through an integrated circuit. Human sense receptors pick up information from the

world. They then transform it and relay it along the line to other units or transistors. The control unit for the system is the brain, which is characterized as a highly sophisticated computer. The brain sorts, classifies, and stores all incoming information. It also gives "executive commands" to the body (Gagne & Driscoll, 1988, p. 12).

Gazzaniga has conducted original research on the brain. One of his findings is that the left hemisphere and the right hemisphere perform very different functions. The left hemisphere performs activities related to language and logic. The right hemisphere, on the other hand, is intuitive and holistic. Under normal circumstances the two hemispheres communicate back and forth with one another. However, if the brain becomes injured, they may operate separate from one another. So, in a matter of speaking, one hand does not know what the other hand is doing. Gazzaniga's research has led him to reject the functional psychology of James and Dewey. The brain is not a tool for adapting the human organism to its environment. "Brain and mind," Gazzaniga (1998) informs us, "are built from discrete units-or modules-that carry out specific functions" (p. 55). It is more accurate to think of the brain as a "collection of devices that assert the mind's information processing demands" (p. 55).

Science. Computers have become an essential part of our everyday lives. The architecture of the computer, however, has remained essentially the same since Alan Turing's World War II design. All modern computers-from supercomputers to smart phones-use a computing unit for making calculations and a separate storage unit for holding programs and data. Shuttling information back and forth between these two units takes time and energy. What if, contend Di Ventura and Pershin (2015), we were able to build a new generation of Memcomputers that worked more like human brains (pp. 56-61). The brain uses neurons to both compute and store information. A memcomputer would have a single unit for performing both storage and processing functions, thus facilitating a great leap forward in speed and efficiency. "In computer terminology," Di Ventura and Pershin inform us, "this is called polymorphism, the ability of one element to perform different operations depending on the type of input signal. Our brains possess this type of polymorphism . . . but our current machines do not have it" (p. 61). Finally, if we were successful in building a memcomputer, it might tell us some very important things about how our own brains work.

It is time, says Markram (2012), we changed the way we study the brain. In the past we have used a reductionist biological approach-examining individual brain parts, such as neural circuits and modules-to understand the workings of the brain. Such an approach has fallen far short of taking us to our goal. A new paradigm that utilizes both analysis and synthesis is required. The various parts of the brain must be viewed within a working whole. The Human Brain Project does exactly that. "The key to our approach is to craft the blueprint according to which the brain is built" (p. 52). The project is designed to create, "a computer simulation of the 89 billion neurons our skull and the 100 Trillion connections that wire those cells together" (p. 54). Such a copy of the human brain would allow research on cells and circuits within the brain.

Romanticism

Philosophy. Romanticism combines the naturalism of Francis Bacon with the philosophical idealism of Plato. The workings

of the outer world are fused with those of the inner world. The principal figure responsible for accomplishing this new synthesis was Jean J. Rousseau, whose literary genius was one of moving the focus of philosophy away from the head (logic) and redirecting it toward the heart (intuition). Rousseau (1762/1954) was a rebel who rejected the established conventions of his time. He wrote with passion and power, declaring in the *Social Contract*, "Man is born free, and everywhere is in chains" (p. 344). Humans were meant to be free, living in accordance with nature. The romantics' love of nature knew no bounds. They believed nature held within itself a mystical spirit of wisdom and goodness. Mankind could tune into this spirit through intuition. Feeling and emotion, not reason, would direct us toward the life of virtue. Thoreau (1854/1951) expressed his reverence for nature when he wrote in *Walden*: "I went to the woods because I wished to live deliberately, to front only the essential facts of life, to see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived" (p. 421).

Romantics were responsible for promoting a heightened sense of individualism. The individual person should resist the pressures to conform to social conventions. The true individual would be like Shelley's Prometheus, struggling to break free of his (or her) bonds. Melville (1851/1969) expressed a similar sentiment when he wrote: "Delight is to him-a far, far upward and inward delight-who against the proud gods and commodores of this earth, ever stands forth his own inexorable self" (p. 392). The romantics glorified self-expression as the essence of humanity itself. The freedom to think and to say what one thought was of paramount importance. Emerson (1841/1951) captured the spirit of individualism in his essay on *Self Reliance* when he advised: "To believe your own thought, to believe that what is true for you in your private heart is true for all men-that is genius" (p. 583).

Psychology. Jean Piaget was a Swiss educator who devoted his career to studying the cognitive development of children. He was interested in examining the psychological processes underlying logical operations. Piaget (1968) tells us that his goal was to discover "a sort of embryology of intelligence" (p. 245). He believed logical thinking is not inborn. Humans learn to think logically as they adapt and seek to establish a working equilibrium with the environment. To expand upon his theories, Piaget founded the International Center for Genetic Epistemology in Geneva. The theory of knowledge, he argued, should be grounded in the biological sciences. Piaget (1968) hoped to develop "a scientific epistemology founded on mental development" (p. 251).

The most popularized aspect of Piaget's and Inhelder's (1969) theory is their division of human growth into four stages: sensorimotor (ages birth to 2 years); preoperational (ages 2 to 7 years); concrete operational (ages 7 to 11 years); and formal operational (ages 11 into adulthood). Though some children may enter or exit stages sooner or later than other children, they all pass through the same four stages. "Thus the unfolding of the stages may give rise to acceleration or retardation, but their sequence remains constant" (p. 153). One stage becomes the logical prerequisite for the next. Learning skills acquired in an early stage are included and expanded in later stages.

There is more of Rousseau's Romanticism in Piaget's genetic epistemology than is generally recognized. Rousseau's *Emile*, for example, is the progenitor of Piaget's child. Piaget's metaphor-his model of the learner-is an updated *Emile*. There are a number of striking similarities between Rousseau's *Emile*

and Piaget's child: both are solo learners, acquiring knowledge from personal experience rather than from others; both are swept through childhood by natural stages of growth and development, mastering at each stage what they are ready to learn; both are exceedingly egocentric, only slowly emerging from its grip; both are tactile learners, constructing their ideas from hands-on experiences; both acquire reading, writing, and arithmetic largely on their own, following an inner timetable of cognitive development; and finally, both act as their own teachers, constructing theories about the world when such schemes are required. Piaget (1970) acknowledged Rousseau's significance when he said Rousseau developed "an educational theory with the most elaborate refinement of detail, one that can be taken either as a brilliant anticipation of the 'new method' of education or as a mere fantasy" (p. 140).

Science. Teilhard de Chardin was a 20th century Catholic priest who was also a noted scientist. He made it his life's work to create a synthesis of traditional Christian doctrine with Darwin's theory of evolution. To Chardin evolution was not merely a biological phenomenon; it was also a spiritual principle at work in the universe. The whole of God's creation was moving toward some teleological end. MacLellan (1988) tells us that Chardin made Jesus Christ the central figure in God's creation. "Christ has the role not just of being Saviour of mankind as he is usually taught to be, but of the whole cosmos" (p. 61).

Jesus, far from being a simple Jewish boy who got himself into trouble with the Romans, was in reality the Cosmic Christ. Jesus was and is the beginning and the end of the whole of God's creation. Christ is the magnetic force causing all things to converge. MacLellan (1988), describing Chardin's theology, tells us that the whole of the cosmos is moving toward a spiritual unification. "What they converge on finally is God in Christ. From the risen Christ comes the power which draws the whole of the cosmos toward its destined end" (p. 37).

Dualism

Philosophy. Dualism constitutes the third composite philosophy, which is a wedding of realism and idealism. The thinker who was most responsible for articulating the metaphysics of dualism was the 17th century philosopher, Rene Descartes. According to Descartes, the world is composed of two different substances, material and spiritual. Material substances are subject to the laws of science; spiritual substances are ethereal and possess freedom of will. Humanity is a prime example of the two substances coming together. The body is a machine; the soul is the seat of consciousness. "My soul," Descartes declared, "is not in my body like a pilot in a ship" (Urmson, 1965, p. 94). Rather, the soul is one with the body. It leaves the body when the body dies. Descartes believed the meeting place where the body and the soul came together was in the pineal gland, which had only recently been discovered in his time.

Mind-body dualism is the prevailing metaphysics of most of humanity. Three of the world's great religions-Judaism, Christianity, and Islam-all have a just God at their center. Buddhism, though it does not have a clearly defined Supreme Being, holds out the promise of nirvana, which is a mystical union of the soul with Total Being. Similarly, Confucianism was primarily an ethical system for ordering relationships within society. The spiritual beliefs of classical Chinese civilization were taken care of by ancestor worship. If you showed proper respect for your ancestors, they would help you

with your day-to-day concerns. Recent years have witnessed a revival in spiritual matters. There have been a plethora of books published on near death experiences, cases of reincarnation, and angels who show up mystically in people's lives. A genuine atheist is becoming increasingly hard to find.

Psychology. James Hillman (1997), writing in *The Soul's Code*, often sounds more like a theologian than a psychologist. His thinking on human personality reflects a dualistic metaphysics. Hillman does not deny the influence of either heredity or environment. He believes, however, there is a third and more important factor, soul or daimon. "We bear from the start the image of a definite individual character with some enduring traits" (p. 4). Indeed, the soul may be responsible for selecting the right heredity and proper social environment that will allow the soul to realize its purposes here in this world.

Hillman (1997) uses an acorn metaphor when speak about the formation of human character. Acorn theory "holds that each person bears a uniqueness that asks to be lived and that is already present before it can be lived" (p. 6). Our inner spiritual acorn supplies us with an image of our life and destiny. "As the force of fate, this image acts as a personal daimon, an accompanying guide who remembers your calling" (p. 39). Everyone enters the world with some particular calling, not just saints and sinners. One's calling is the "essential mystery at the heart of each human life" (p. 6).

Hillman (1997) believes 18th century rationalism is responsible for many of our mistaken ideas about human personality. The belief that the real is rational and the rational is real has lead to many mistaken conclusions. One such conclusion has been the folly of reducing mind to brain. Why are we so persistent in equating the two? Hillman (1997) tells us we refuse to give it up "because it is so basic to our Western rationalist and positivist mind-set" (p. 150). Today, more than ever, rationalism has become linked with computers and artificial intelligence. "It is the international style of the mind's architecture" (p. 152).

Science. Georges Lemaitre was a Belgian priest who was also a recognized mathematician and physicist. He was among the first to carry Einstein's theory of general relativity to its logical conclusion. Lemaitre surmised correctly that if the universe were expanding, though Einstein initially rejected such an idea, then it must have had a beginning. In its beginning the universe must have been a "primeval atom" that was incredible hot and dense. Lemaitre is credited with furnishing today's cosmology with two catchy metaphors-the "Cosmic Egg Theory" and the "Big Bang Theory" (Kaku, 2006, p. 51).

Tertullian, who was an early Church Father, posed a question that has haunted Christianity to this day. Tertullian phrased the question this way: "What indeed has Athens to do with Jerusalem" (Artz, 1954, p. 66)? A modern writer might rephrase the question: Are science and religion compatible? Tertullian's answer was that Athens (reason) had nothing to do with Jerusalem (faith). Reason and faith belonged to separate categories, and the two categories should not be mixed. Lemaitre arrived at the same conclusion. Science and religion are two separate ways of looking at the world. Science cannot be used to prove or disprove objects of faith; likewise, faith should not stand in the way of scientific inquiries. When Pope Pius XII declared that Lemaitre's "Cosmic Egg Theory"

supported Christian doctrine, Lemaitre was quick to reject such an idea.

CONCLUSION

Modern physics has created its own version of the riddle of the sphinx. Can the paradox existing between Einstein's theory of general relativity and Bohr's theory of quantum mechanics be resolved? "General relativity," Greene (1999) informs us, "provides a theoretical framework for understanding the universe on the largest of scales" (p. 3). Quantum mechanics, on the other hand, "provides a theoretical framework for understanding the universe on the smallest of scales" (p. 3). The validity of both theories has been confirmed experimentally. However, "as they are currently formulated, general relativity and quantum mechanics cannot both be right" (p. 3).

Why has the riddle of modern physics proven so hard to solve? The metaphysical assumption of realism lies at the heart of the problem. Realists believe we live in a world of things and events that exist independent of their being known by human minds. The laws of nature govern a reality external to our selves. These laws are part of the fabric of the universe; they are not in any way dependent upon how we think or feel. If we wish to understand reality, we must align our thinking to correspond with the way the world turns. Rovelli (2016) was speaking as a realist when he wrote: "The images that we construct of the universe may live inside us, in conceptual space, but they also describe more or less well the real world to which we belong" (p. 68).

Which pair of metaphysical spectacles do you put on when you roll out of bed in the morning, realist or idealist? "Thinkers," Wheeler (1994) informs us, "have debated for centuries before and after Leibniz and Berkeley between 'realists' and 'idealists' views of existence and the debate is as far as ever from being ended today" (p. 27). If you are a realist, you will be inclined to stand with Einstein. If, on the other hand, you are an idealist, you will more likely show an affinity for Bohr. Realists look at general relativity and quantum mechanics and see a paradox, pure and simple. Idealists, however, look at the same two theories and do not find any unsolvable problem. The idealist views theories as metaphorical tools for solving different kinds of problems. For example, general relativity is like a hammer. With respect to spacetime, we might say Einstein really "nailed" that one. Quantum mechanics is more like a jug saw designed to "cut out" novel and eye-catching patterns. If physicists should ever happen to formulate a theory of everything, it might look something like a Swiss Army Knife-a compact tool containing a wide variety of smaller tools.

How to unlock the riddle of the sphinx? Wheeler (1994) has offered us a key. "Useful as it is under everyday circumstances to say that the world exists 'out there' independent of us, that view can no longer be upheld. There is a strange sense in which this is a 'participatory universe'" (p. 126). If humans play and active role in creating "reality," then metaphors become increasingly important in formulating new scientific theories. Likewise, if general relativity and quantum mechanics are merely metaphorical tools, then there isn't any paradox waiting to be unraveled. General relativity and quantum mechanics are simply tools designed to solve different kinds of problems. There is no "reality" independent

of human experience; there is no “truth” except human truth; and there are no “facts” floating freely around in the cosmos. The riddle of sphinx, when taken as a metaphorical expression of scientific thought, is released from all of its paradoxical powers. What kernel of “truth” can be drawn from all of this philosophizing? To paraphrase the Sophists-metaphor is the measure of mind.

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