MODELS AND METAPHORS

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ABSTRACT. Humanity delights in spinning conceptual models of the world. These models, in turn, mirror their respective root metaphors. Three root metaphors – spiritual, organic, and mechanical – have dominated western thought. The spiritual metaphor runs from Plato, through Hegel, and connects with Montessori. The organic metaphor extends from Aristotle, through Darwin, and joins with Dewey. And the mechanical metaphor stems from Democritus, through Newton, and links with Skinner. The three metaphors have played a germinal role in western philosophy. They have also shaped the character of educational thought and practice. Which model to choose? Your choice will depend upon the purpose or aim you have in mind.

> Fanaticism consists in redoubling your efforts when you have forgotten your Aim. (George Santayana)

MODÈLES ET MÉTAPHORES

RÉSUMÉ. L'humanité prend plaisir à échafauder des modèles conceptuels du monde. Ces modèles, à leur tour, reflètent leurs métaphores-racines. Trois métaphores-racines – spirituelle, organique et mécanique – dominent la pensée occidentale. La métaphore spirituelle part de Platon, passe par Hegel et conduit à Montessori. La métaphore organique se développe à partir d'Aristote, passe par Darwin et débouche sur Dewey. Et la métaphore mécanique provient de Democritus, passe par Newton et mène à Skinner. Les trois métaphores ont joué un rôle embryonnaire dans la philosophie occidentale. Elles ont également façonné le caractère de la pensée et de la pratique en matière d'éducation. Quel modèle choisir? Votre choix dépendra de l'objet ou du but que vous vous êtes fixé.

> Le fanatisme consiste à redoubler d'efforts lorsque vous avez oublié votre but. (George Santayana)

INTRODUCTION

Have you ever watched a spider at work? Spiders are fascinating little insects. They spin their webs with precision and care. Each web is designed to serve a specific purpose. Ground spiders spin one kind of web; tree spiders weave a very different design. *How* the spider spins its web depends on the kind of insect the spider intends to catch. Beetles require a heavy duty web; flies demand a more ephemeral trap. Web spinning is a highly purposeful activity.

Humans, metaphorically, are like spiders. They spin symbolic systems representing the world. "What most distinguishes humans from other creatures," says DeLoache (2005) in *Scientific American*, "is our ability to create and manipulate a wide variety of symbolic representations" (p. 73). The human mind is composed of a plethora of symbolic systems. Some are designed to resolve earth-bound problems (science). Others address more ethereal conundrums (religion). The design of an intellectual system is determined by the purpose it is intended to serve. No single theoretical system is able to catch all the "beetles and flies."

Intellectual systems represent models of how human imagination conceptualizes the world. These models, in turn, are based on a handful of root metaphors, which serve as building blocks for thought. Pepper (1972), in *World Hypotheses: A study in evidence*, tells us that: "A world hypothesis is determined by its root metaphor" (p. 96). Root metaphors (or models) tend to fall into three different categories – spiritual, organic, and mechanical. Spiritual models look to the celestial; organic models favour the biological; and mechanical models revel in science and technology. Over the years all three have attracted their supporting cast of characters.

Spiritual models

Is there a God? That is one of the great metaphysical mysteries. Scores of people believe in one. They see the handiwork of God everywhere. The belief in supernaturalism is as old as humanity itself. Primitive people (and some modern ones) have tried to control the supernatural through ritual and magic. According to Sir James G. Frazer (1951) in *The Golden Bough*, there is a bit of the shaman in every priest and more than a little of the alchemist in every scientist. All the world's great religions postulate a spiritual force at work in the universe. Life reflects a plethora of intricate designs—the atom, DNA, the cell – which seem to suggest an intelligent designer lying behind nature.

Many philosophers have been attracted to spiritualism or idealism. Plato was one of the first to build his metaphysical system around other-worldliness. His famous analogy (metaphor) of the cave presents a persuasive argument. Suppose, Plato (1968) tells us in the *Republic*, that a group of prisoners

had spent their entire lives in a cave, "chained by the leg and also by the neck" (p. 227). Visualize a large bonfire at the mouth of the cave. People are parading objects past the bonfire so that the light casts shadows on the wall of the cave. "Such prisoners would recognize as reality nothing but the shadows of those artificial objects" (p. 229). Plato (1968) offers the following interpretation of the story:

> The prisoners dwelling corresponds to the region revealed to us through the sense of sight, and the fire-light within it to the power of the Sun. The ascent to see the things in the upper world you may take as standing for the upward journey of the soul into the region of the intelligible. (p. 231)

Though Plato was the founder of idealism, he was certainly not the last philosopher to endorse a spiritual metaphor. Hegel, the great nineteenth century German philosopher, used it to construct an elaborate system of absolute idealism. Hegel posited mind or spirit as the primary reality in the world. History, Hegel (1954) argued, is God thinking out his will in the affairs of humanity. Nothing ever happens in history that God does not intend. "Reason rules the world" (p. 4). The hand of God can be seen everywhere. Hegel maintained that the state is the divine idea as it exists on earth. Each nation-state represents a particular spiritual idea. The conflict between states is not only inevitable but necessary to complete the dialectic. The dialectical movement – thesis, antithesis, synthesis – carries history forward. Hegel (1954) believed Germany was the nation charged with the mission of carrying humanity forward in his time. "The destiny of the Germanic people is to be the bearers of the Christian principle. The principle of spiritual freedom of reconciliation and harmony" (pp. 88-89).

Hegel's philosophy found its way into American education through the work of William Torrey Harris. Harris served as Superintendent of Schools in St. Louis from 1869 to 1880, where he was instrumental in helping to start the first public kindergarten in 1873. Harris later became United States Commissioner of Education from 1889 to 1906. In addition to being an eminent administrator, Harris was an able scholar, serving as editor of the *Journal of Speculative Philosophy*. Hegel's dialectic provided Harris with his doctrine of self-estrangement. Humanity, Harris argued, has two selves – a natural self and a spiritual self. Humanity's true self is the spiritual one, which is essential for living in society, but it is in opposition to the natural self. Education calls for the submission of humanity's natural or animal self to the spiritual or social self. Education must "estrange" the student from his or her natural self by helping him or her to adapt to the mores of society (Rippa, 1967, pp. 183-188). The will of the individual (thesis) is placed in direct conflict with the expectations of society (antithesis). By replacing our animal appetites with the expectations of society, we can move to a higher plane of existence (synthesis).

As Harris was the principal voice for idealism in education during the late nineteenth century, so Montessori became its chief spokesperson in the first half of the twentieth century. Maria Montessori (1970) is an interesting example of a thinker who, though trained in the medical sciences, drew her educational inspiration from mystical intuition. She is an example *par excellence* of spiritualism at work in the realm of education. Montessori maintained that every child is born with a spiritual secret carefully tucked away inside of himself or herself. The child is a "spiritual embryo" whose destiny, like the butterfly, is to leave its cocoon. The hand of an unseen divinity guides the development of the child. Montessori was fond of quoting Wordsworth: "The Child is father to the Man." The work of the child is to construct the personality for what will become the adult. We are all the psychological by-products of the choices we made for ourselves when we were children. Where do these psychic parts come from? Some are borrowed from our fathers; others we acquire from our mothers. How does the child know which parts to select? That is the child's secret.

Montessori (1970) refers to children as "spiritual embryos" (p. 24). Every living creature "contains within itself mysterious guiding principles which will be the source of its work, character, and adaptation to its surroundings" (p. 24). Hidden in the soul of the child is a secret which is only slowly revealed in terms of its development. "That is why it is the child alone that can reveal the plan that is natural to man" (p. 25). In order to free the "spiritual embryo" from its cocoon, Montessori set out to educate what she called a "normalized" child. Such a person had freed himself or herself from the neurotic habits imposed by unthinking adults. The child, once properly educated, would lead humanity into a brighter future. The child holds within himself or herself a hidden wisdom, which, once unlocked, will show humanity the road to its salvation.

Montessori established her schools in order to "normalize" the education of children. These schools featured her famous didactic materials. The didactic materials served as both the carriers of control as well as instruction. They provided the children with a path to learning and development. By manipulating these concrete materials, the children acquired abstract ideas. However, once children had been shown the proper use of the materials, they were given complete freedom to work on their own. The teacher was not to enter into the children's activities in any way. Children were not pressured to hurry and complete tasks. They were allowed to progress at their own pace. Montessori found the children in her school preferred working with the materials to playing with toys. Rewards for work well done were not necessary. Learning was its own reward. When Montessori offered the children candy, they placed it in their pockets and went on working (Lillard, 2005, pp. 289-324).

If children hold the keys to their own development, why have so many children gone astray? Adults, according to Montessori (1970), are too inclined to make untimely intrusions into children's activities. Misguided meddling on the part of adults interferes with children's natural development. "Men, through their interference with these natural laws, have hindered the divine plan for children and, as a consequence, God's plan for men themselves" (p. 41). How can teachers assist the development of the "spiritual embryo"? They can provide children with a proper learning environment. "It is through the environment that the individual is molded and brought to perfection" (p. 43).

Growth is not a gradual process of uniform increments. The growing child passes through many radical transformations. The child at one stage is hardly the same person he or she was at an earlier stage. Montessori (1963) refers to these changes as similar to "metamorphosis." The child is like a butterfly, taking on many different forms. Periods of moderate growth alternate with ones of rapid transformation. The bodily proportions of a newly born infant, for example, are completely different from those of an adult. Life is a process of birth and rebirth. As one psychic individual fades away, a new one emerges to take his (or her) place.

Montessori (1963) believed children passed through three major stages of personal development. The first stage extends from birth to age six. "This period is characterized by great transformations that take place in the individual" (pp. 14-15). The mind during this period functions like a sponge, absorbing impressions from the world.

Knowing is closely linked to manipulating things with one's hands. The second period begins at age six. "The period from six to twelve years is one of growth, but not transformation" (pp. 14-15). Growth during the second stage is smooth and uniform. The third stage, which is from twelve to eighteen, is one marked by a final transformation. New emotions – doubt, hesitation, discouragement, introversion – emerge. At the close of the third stage, the person becomes an adult. After adolescence there is no further growth, the person merely becomes older.

Montessori's school offered children a carefully prepared environment in which to develop naturally. During the first period of education, three to six years, there was no direct instruction by the teacher. The children were given the freedom to learn and explore on their own. Through their activities, the children taught themselves the basics of reading, writing, and arithmetic. "It seems absurd," Montessori (1963) informs us, "to our usual way of thinking, that grammar should be taught at three, before reading or writing, but the children were keenly interested in it, as older children were not" (p. 72). Reading and writing did not have to be drilled into the children. Montessori discovered that children between the ages of four and five, without

any assistance from the teacher, spontaneously began to write. They wrote as if possessed by the god of prose. Writing seemed to fulfill an inner need. Then, just as suddenly, about six months after they had started to write, the children began to read. They discovered that writing was another way of communicating. Both writing and reading were acquired painlessly, growing out of the children's natural activities (Gutek, 2004, pp. 17-19).

The teacher in Montessori's school took on the role of custodian of the environment. He or she was responsible for preparing and presenting the didactic materials, which were to be kept clean, shiny, and in good condition. Learning was not acquired by listening to the words of the teacher. Meaningful learning came from acting upon the environment. Montessori renamed her teacher the "directress," whose role was to place the child in contact with the carefully prepared environment (Gutek, 2004). "Once the child's interest has been aroused," Montessori (1963) tells us, "the teacher withdraws into the background, and must be very careful not to interfere – absolutely not, in any way" (p. 88). Even well-meant praise can do great harm. "If the child is in some difficulty, the teacher must not show him how to get over it, or the child loses interest" (p. 88). The teacher's single duty is to provide new materials and activities when the child masters the old ones. "Human teachers can only help the great work that is being done, as servants help the master" (p. 3).

One of the central tenets of Montessori's method is that the child passes through sensitive periods. These are times when the child shows a predisposition toward certain types of learning. Sensitivity guides the child's course through the various stages of development. When under the influence of a sensitivity period, the child will show an insatiable appetite for the acquisition of some particular kind of knowledge or skill. Sensitivity periods serve to help the child acquire adaptive skills. Once the child has passed through a period, the sensitivity disappears. "When a particular sensitiveness is aroused in a child," Montessori (1970) assets, "it is like a light that shines on some objects but not on others, making them his whole world" (p. 51). Walking, talking, reading, and mathematics – each has its sensitivity period. The longest sensitivity period is centered on the acquisition of language. Language sensitivity extends over the first six years of life. This is why the child learns language so effortlessly. Sensitivity periods are connected to learning tasks in the growth process. Once a task has been mastered, the special sensitivity disappears. If, however, a particular task is not mastered "the opportunity of a natural conquest is lost, and is lost for good" (p. 48). The failure to develop properly may have disastrous effects upon a child's future behaviour.

Montessori (1970) assigned great importance to the value of work. Through work the damaged child is "normalized," allowing him or her to construct

a healthy adult personality. "A child's desire to work represents a vital instinct since he cannot organize his personality without working; a man builds himself through working" (p. 228). The child's work is far different from the adult's. The adult labours in the world; the child labours on him or herself. The work of the child is to fashion the adult who is in the process of becoming.

Montessori (1970) was not content with merely describing the growth of little children. Her real agenda was to explain the cosmic mission of humanity. By "normalizing" the education of children – allowing them to develop naturally in an enriched environment – educators would be able to unlock the mystery of humanity 's destiny. Children have concealed within themselves "a vital secret capable of lifting the veil that covered the human soul, that they carried within themselves something which, if discovered, would help adults to solve their own individual and social problems" (p. 10). The child is the teacher of humanity. He or she holds the key to producing a better type of human being. "Within the child lies the fate of the future" (p. 255). The child holds the secret to the salvation of the human race. The child possesses an inner power to redirect the course of history. "If salvation and help are to come," Montessori (1963) contends, "it is from the child, for the child is the constructor of man, and so of society" (pp. 1-2).

Organic models

All organic models share one thing in common – a proclivity for biological metaphors. Reality is like a living organism. All of its various parts work together in order to preserve the life of the whole. Organists are fond of telling us "that the whole is greater than the sum of its parts." In order to understand the various parts, it is necessary to study them in relationship to the whole. The use of biological models is at least as old as Aristotle, who left us with the famous analogy of the acorn. The acorn, like all of life, is governed by a teleological principle. Its growth moves from potentiality (a more matter-like state) to actuality (a more form-like state). Just as acorns become oak trees, so, too, infants become adults. Everything in life is moving toward realizing itself. Aristotle's philosophy, largely through the work of Saint Thomas Aquinas, came to dominate medieval theology (Urmson, 1965, 28-51).

Modern thought has been greatly influenced by the theory of evolution, which came of age with the publication of Charles Darwin's *Origin of Species* in 1859. Darwin argued that all organisms, living and dead, including humans, are the end products of a long, slow, natural process of development from a few simple forms of life. Darwin's theory revolutionized humanity's view of its place in the universe. Rather than descending from the heavens, humans dropped out of the trees. Humans are just another primate created by natural selection. Darwin discovered the driving force for his theory in

Malthus' *An Essay on the Principle of Population* (1798). Malthus argued that populations tend to increase faster than the available food supply. Thus there is a pressure on the land. We live in an "eat or be eaten world" where only the fittest survive.

Herbert Spencer was a social theorist who jumped eagerly on the Darwinian bandwagon. Spencer applied Darwin's biological theory to human society. The law of evolution not only controls humanity's physical characteristics, but it determines our social progress as well. Evolution, Spencer argued, is far wiser than the brightest of politicians or reformers. Natural selection applies to social institutions as well as to primeval forests. The prudent course of action in human affairs is to follow a policy of laissez-faire. The poor, as Jesus once noted, are always with us. The state should not try to save people from themselves. William Graham Sumner, a pioneer sociologist, argued that "'a drunkard in the gutter is just where he ought to be.'" The sooner he or she is out of the way, the better it will be for everyone (Rippa, 1967, pp. 170-171).

Not all Darwinians are hard-hearted. Some show great empathy for their fellow citizens. The theory of evolution does not preclude our having a moral conscience. John Dewey infused Darwinism with a sense of social justice. He used the theory of evolution to reconstruct (his purpose) American philosophy. Dewey, building on a biological metaphor, saw life as an organic whole. Every part of life is continuous with every other part. Nature does not have any skips, gaps, or dualisms. Humans are as much a part of nature as spiders and fruit flies. "Man's life," Dewey (1960) informs us, "is bound up in the processes of nature; his career, for success or defeat, depends upon the way in which nature enters it" (p. 267). Humanity does not represent a special form of creation. "Man is continuous with nature, not an alien entering her process from without" (p. 333).

The growth metaphor comprises the articulating centre of Dewey's philosophy. Nothing is more fundamental to his thinking. Dewey's commitment to growth led him to select biological and organic models. During his early career, Dewey was strongly influenced by Hegel. When he rejected Hegel's idealism, he replaced it with Darwin's evolutionary naturalism. Hegel and Darwin, though differing in most respects, shared one thing in common – the belief that life is an integrated, organic whole. Dewey placed the principle of organism front and centre in his philosophy. It can be seen at work in his treatment of such diverse topics as nature, society, democracy, and education. Growth, for Dewey, represents the very essence of life itself (Bernstein, 1967, pp. 380-385).

Dewey's theory of knowledge is linked to Darwin's theory of evolution and to James' functional psychology. The label he picked for his philosophy, instrumentalism or experimentalism, conveys the importance evolution and

functionalism had on his thinking. Every living creature, Dewey argues, must make an adaptation to its environment. Each organism has evolved its own specialized physical characteristics or instruments for accomplishing this task. The hawk is swift of wing and keen of eyesight; it is endowed with powerful talons and a sharp beak with which to catch and devour its prey. The turtle, on the other hand, has a hard shell to retreat into whenever trouble threatens. What is humanity 's instrument for survival? Dewey's answer is intelligence. Mind is an instrument for solving problems and adapting the human organism to its environment. Thinking is a form of activity humans engage in whenever habitual patterns of action are disrupted. Thinking is problem-solving activity. Its function is to reestablish satisfactory relations between the organism and its environment (Feldman, 1968).

The growth metaphor can be seen in all of its glory in Dewey's ethics. Because the world is one of constant change, no fixed or attainable goals can be established as moral ideals. The reality of life is the growth process itself. To be growing is what is meant by the good. Actions are good if they contribute to growth; they are bad if they restrict or retard growth. The thief, even if he or she is not caught, cannot glory in his or her newfound wealth. Stealing is, by its very nature, an antisocial activity. Such acts always cut the individual off from the larger community. They interfere with his or her total growth (Dewey, 1959, pp. 28-29).

There are no fixed or eternal ends in Dewey's (1960) philosophy. Ends are merely means to further ends. "Every means is a temporary end until we have attained it. Every end becomes a means of carrying activity further as soon as it is achieved" (p. 124). Goals are discrete and tentative, subject to change. Dewey (1963) argues that growth provides the only legitimate criterion of moral worth. He writes in *Reconstruction in Philosophy*:

> Not perfection as a final goal, but the ever-enduring process of perfecting, maturing, refining is the aim of living. Honesty, industry, temperance, justice, like health, wealth and learning, are not goods to be possessed as they would be if they expressed fixed ends to be attained. They are directions of change in the quality of experience. Growth itself is the only moral "end." (p. 177)

Dewey's work in aesthetics, though it came late in his career, cannot be ignored or dismissed as insignificant. The qualitative dimension of human experience is one of the central themes running through his entire philosophy. Dewey views works of art as being analogous to little life-worlds. They are richer, more complex and multifaceted than our attempts to assign them fixed meanings. Artistic creations blend diverse elements into an organic whole (Boisvert, 1998). Dewey (1948) sought to infuse ordinary, everyday experience with aesthetic qualities. Artistic activity "provides the pattern and model of the full and free growth of personality and a full life activity, wherever it occurs, bringing refreshment and, when needed, restoration" (p. 10).

Democracy represents the central value around which Dewey organized his social and educational philosophy. Democracy is more than a form of government; it is a universal principle which, when acted upon, produces the good society. A democratic society is like a living, growing work of art where all of the individual elements are combined into a coherent whole. Why are democratic arrangements preferred over all others? A democratic society is one that facilitates optimum growth, individual and social. In a democracy, there is complete and open interplay between competing social forces and ideas. No group is walled off or discriminated against. Individual variations are treated as precious because they furnish the means by which the whole society is able to grow. "Democratic social arrangements," Dewey (1959) argues, "promote a better quality of human experience, one which is more widely accessible and enjoyed, than do non-democratic and anti-democratic forms of social life" (p. 25).

Rarely has any professional philosopher shown as much interest in education as John Dewey (1960). He even went so far as to define philosophy "as the general theory of education" (p. 383). Dewey believed education could serve as a proving ground for testing philosophical ideas – a way of examining theory within the context of practice. The Laboratory School at the University of Chicago offered Dewey a mechanism for testing his instrumentalist philosophy; it also provided him with a rich background of experiences upon which to draw. Dewey (1960) maintained that an educational system must reflect the character of the society it serves. The industrial revolution had radically altered the nature of American life. Education had to be redesigned to reflect the emerging social order. The new school had to mirror the world from which children came. The school should incorporate within itself the principal characteristics of a model home and a miniature community. "The school becomes itself a form of social life, a miniature community and one in close interaction with other modes of associated experience beyond school walls" (p. 418).

The problem with the traditional school, Dewey argued, was that it was designed for listening. Teachers talked; students listened. Classrooms were not organized to encourage children to actively engage in problem solving. Furthermore, there was little continuity between what the children learned in school and what they experienced at home. The school was isolated from life. This dualism – the separation of school from life – was not an inevitable consequence of schooling. Dewey (1960) believed the dualism could be resolved by building the curriculum around social occupations. Occupations offered an appropriate way for children to reproduce the work of an industrialized society. When studied within a social context, they provided convenient avenues for the study of science, geography, and the history of human culture. By making occupations the articulating centre of the curriculum, the school would take on a new life and purpose. "Educa-

tion through occupations consequently combines within itself more of the factors conducive to learning than any other method" (p. 361). Instruction should begin with active occupations and later proceed to an examination of the scientific materials and laws underlying the occupations. The children would be encouraged to use their minds as instruments for solving problems. "With the growth of the child's mind in power and knowledge, it ceases to be a pleasant occupation and become more and more a medium, an instrument, an organ of understanding – and is thereby transformed" (Dewey, 1916, p. 20).

The Laboratory School attracted the attention of progressive educators, thereby placing Dewey at the vanguard of educational reform. Dewey and his daughter, Evelyn, published *Schools of Tomorrow* in 1915. The book was an immediate success, going through 14 printings in 10 years. Dewey was celebrated as one of the leaders of the progressive movement. The euphoria of the early years, however, was short-lived. By the 1930s, Dewey had become one of progressive education's most telling critics. What disturbed him about the progressives were their unreasoning excesses. In his 1938 book, *Experience and Education*, Dewey (1959) tried to set the record straight. He warned the progressives about their own dogmatism.

> An educational philosophy which professes to be based on the idea of freedom may become as dogmatic as ever was the traditional education which it reacted against. For any theory and set of practices is dogmatic which is not based upon critical examination of its own underlying principles. (p. 10)

Dewey was also forced to rethink his position on the role of education in social reform. Early in his career he had advocated using the public schools as instruments to reform and democratize American society. Later, however, he arrived at a very different conclusion. "It is unrealistic," Dewey wrote in 1937, "to suppose that the schools can be a main agency in producing the intellectual and moral changes, the changes in attitude and disposition of thought and purpose, which are necessary for the creation of a new social order" (Westbrook, 1991, p. 508). The defects found in the schools mirrored those found in the larger society. Schools can take part in meaningful social change only as they ally themselves with other democratic forces. They cannot on their own remodel the basic nature of American society.

Dewey (1960) viewed moral education as being synonymous with the principle of growth. Children acquire moral principles by learning how to cooperate in shared undertakings. "All education which develops the power to share effectively in social life is moral" (p. 418). Children do not acquire moral habits by listening to adults preach time-honoured sermons. Moral rules are learned by entering into proper relations with others. "Interest in learning from all the contacts of life is the essential moral interest" (p. 418). The genuinely moral person is one who has formed the habit of considering how

his or her actions will affect others. The moral ideal that education strives to achieve is the unified, growing individual.

Dewey's philosophy ended where it began, with the organic model. For Dewey (1960) there is no final end to life. Individual ends and social ends are intimately intertwined. A democratic school, like a democratic society, provides the best opportunities for both the individual and the society to seek their optimum good. Education is the enterprise that supplies the conditions necessary for growth. "Since growth is the characteristic of life, education is all one with growth; it has no end beyond itself" (p. 62).

Mechanistic models

Look around you. Chances are your gaze settles on some gadget invented by our society. We are surrounded by machines – at home, in school, on the playground – which consume our time and energy. Take a peaceful stroll down a country lane – an iPod comes jogging by. Book a vacation flight – the person seated next to you is tapping away on a laptop. Try talking with your mate – his or her ear is glued to a cell phone. We live in a technology dependent society. Witness the panic that ensues when the power suddenly goes off. Is it any wonder we are partial to mechanistic models?

Mechanistic thinking has a long, illustrious history. Like most ideas, mechanism has it roots in ancient Greece. Democritus is noted for his theory of atoms. The whole world, he believed, is composed of very small particles that cannot be seen by the naked eye. Atoms are constantly bumping into one another, thus causing events to occur in the visible world. Democritus, of course, did not know about protons, neutrons, and electrons. He would have been shocked at the idea of splitting an atom. Nevertheless, his speculative science laid the groundwork for philosophical realism and the later investigations of Galileo, who introduced experimentation and measurement into science (Russell, 1954, pp. 71-73). Aristotle had maintained that heavier objects, when dropped, fall faster then lighter ones. (The average person still clings to this belief.) Galileo's experiments contradicted Aristotle's conclusions. "Galileo predicted that bodies in a vacuum fall at the same rate no matter what they are made of – an idea known as the weak equivalence principle" (Barrow & Webb, 2005, p. 63). Galileo's investigations established one of the pillars of mechanistic thinking – that everything exists in some quantity and can therefore be described mathematically (Russell, 1954, pp. 525-540).

The Enlightenment represents the fountainhead of mechanistic thinking. Newton was the godfather of eighteenth century mechanism. Newton's discovery of the Law of Gravity was a momentous feat. All of the mystery was suddenly stripped from the cosmos. The heavens were no longer ruled by God and his angels; rather, they were governed by natural law. The universe

was a gigantic machine, like a perpetual motion clock, whose movements were all finely balanced by the Law of Gravity. If the universe were a clock, reasoned the Deists, then God must be a clockmaker. Since God had created the universe to run according to natural laws, he wouldn't upset everything by performing miracles. Newton's mechanism had a profound effect on economic thought as well. Adam Smith's *Wealth of Nations* capitalized on the same mechanistic model. Smith envisioned the marketplace as a vast machine regulated by the laws of supply and demand. Prudent politicians should refrain from tinkering with the machine. The best policy was one of *laissez-faire* (which evolved into the American doctrine of free-enterprise). The mechanistic metaphor found its way into political discourse.

Montesquieu's *Spirit of the Laws* argued for three branches of government – legislative, judicial, and executive – each serving as a check on the powers of the other two. The founding fathers of the United States had read Montesquieu, and they built his check and balances into the Constitution. Finally, Newtonian thinking came to influence the way we look at ourselves. La Mettrie's *Man the Machine* not only topped off the Enlightenment, but it laid the groundwork for twentieth century behaviourism (Brinton, 1965, pp. 288-318).

B. F. Skinner is a present-day example of a mechanistic thinker in psychology and education. He is the quintessential behaviourist. For a person who professed to dislike theory, Skinner (1961) went out of his way to construct an elaborate ideology complete with its own utopia, *Walden Two*. Skinner exhibits an unabashed faith in the power of science. The scientific method, he believes, can be applied to the solution of human problems. Science can lead humanity to the promise land – a planned community populated with planned people. "We need not worry about the scientific way of life," Skinner (1967) reassures us, "it will take care of itself" (p. 412). Behaviourism, in turn, offered "the most direct route to a successful science of man" (p. 401).

Skinner's behaviourism is grounded in a handful of philosophical assumptions. His primary belief is in the reality of the physical world. The universe is composed of an orderly arrangement of objects and events. All things are governed by natural laws. Every event has as external cause. There is no room for spontaneity or capriciousness in Skinner's model. All behaviour, from atoms to humans, is rigidly determined. Free will is an illusion. Everyone has been conditioned to behave in exactly the way he or she is currently acting. Humans are merely the end products of a long chain of historical events occurring on this planet. Skinner's system does not provide for a God or a human soul. All that exists is the physical reality we know through science (McCue-Ascher, 1965, pp. 389-421).

Skinner's theory of knowledge, empiricism, is linked to his view of reality. All knowledge, he tells us, comes through the senses; there is nothing in

the senses that was not first in the real world. Skinner, like Francis Bacon, holds that knowledge is power. Before nature can be commanded, however, it must first be obeyed. Science is the key to unlocking the secrets of nature. The experimental method can show us how to use nature to serve human purposes. Science can point the way toward building a better world.

Skinner expressed an abiding concern for the survival of the human species. Nuclear war is merely one of the many threats to our survival. Skinner admitted he could not prove, at least through science, that humanity ought to survive. Most people, however, are willing to accept such a proposition. If we can agree on the desirability of survival, the scientific method of inquiry can be applied to all lesser values. Experiments can be conducted on a variety of model communities to see which one produces the desired consequences. Everything from infant care to nursing homes can be put to the scientific test. The most viable patterns can be integrated into the larger community (Sprinthall, et al., 1988, pp. 248-258).

Skinner's principal contribution to behaviourism lies in his theory of operant conditioning. Classical conditioning (Pavlov and Watson) held that most behaviour was respondent – caused by some stimulus in the environment. Skinner, on the other hand, maintained that most behaviour was operant – emitted by the organism as it acts upon the environment. In classical conditioning the organism is assumed to be passive until the desired stimulus is presented. (Pavlov's dogs did not begin to salivate until they got a whiff of the meat powder.) In operant conditioning the organism is assumed to be active. (Thorndike's kittens struggle frantically to escape from their boxes.) An operant is the kind of behaviour an organism naturally tends to emit. Pigeons peck, dogs sniff, and cats sharpen their claws on your new drapes. The term operant, says Skinner (1953), "emphasizes the fact that the behavior operates on the environment to generate consequences" (p. 65).

The success of operant conditioning is contingent upon how well a response is reinforced. Reinforcement may come from any stimulus that increases the likelihood of a behaviour being repeated. There are no blanket reinforcers. What is reinforcing for one person may be a complete turnoff to the next. (Some rats enjoy an electric shock to the brain.) Skinner distinguished between two types of reinforcement, positive and negative. A positive reinforcer increases the probability of a response occurring again. Food works well with hungry animals. Negative reinforcement, on the other hand, is when an organism performs a behaviour in order to avoid or escape unpleasant consequences. If, for example, a rat is placed on an electric grid, it will learn to press a bar to turn of the current. The rat has learned how to escape from a negative situation. Skinner found that by manipulating the contingencies of reinforcement he could create, shape, and change behaviour almost at will (Driscoll, 1994, pp. 27-63).

Skinner conducted extensive research on schedules of reinforcement. He was interested in discovering the relationship between frequency of reinforcement and the continuity of a conditioned response. His studies showed that continuous schedules of reinforcement resulted in faster rates of learning than did intermittent schedules. Continuous schedules, however, led to rapid extinction after reinforcement was withdrawn. Intermittent schedules of reinforcement, on the other hand, gave rise to more continuous, long-term behaviour (Anderson, 1995, pp. 20-24). An excellent example of a variable ratio reinforcer is a Las Vegas slot machine. People will stand for hours and feed their last quarter into such reinforcers.

Feedback is an important aspect of behaviour. It tells the organism what the consequences are of its behaviour. Thus, if one wishes to extinguish behaviour, it is merely necessary to discontinue all consequences. When behaviour is no longer reinforced, it tends to diminish or disappear. Extinction of unwanted behaviour is far more efficient than punishment. Punishment only succeeds in suppressing behaviour, which may crop up in a different setting. The child who is punished for being idle at school will find ways of appearing to be busy (Gage, 1998, pp. 466-467).

Skinner's (1967) interest in schooling stemmed from a visit he made to his daughter's arithmetic class. "Suddenly, the situation seemed perfectly absurd. Here were twenty valuable organisms. Through no fault of her own the teacher was violating almost everything we knew about the learning process" (p. 409). Skinner (1968) concluded that teaching, as it is generally practiced, is a very inefficient and unproductive activity. "Teacher's salaries have not kept pace with those in other professions" (p. 258). This is because "their productivity has not increased at the same rate. Many teachers today are no more productive than teachers of a hundred years ago" (p. 258). Why is teaching in such a pickle? One reason is that as a mere reinforcing mechanism the teacher is out-of-date. In order to improve the efficiency of teaching, Skinner advocated placing a teaching machine in every classroom. Teaching machines offer efficient learning. They can be designed to reinforce student behaviour at appropriate intervals. Teaching machines are also an effective way of motivating students to learn more material. "The mere manipulation of the device," argues Skinner (1968), "will probably be reinforcing enough to keep the average pupil at work for a suitable period of each day" (p. 24). Skinner was optimistic about the future of teaching machines. He saw them as ushering in a new era in education. Skinner (1968) looked forward to a time when "teachers will have more time to get to know students and to serve as counselors. They will have more to show for their work, and teaching will become an honored and generously rewarded profession" (p. 110).

Skinner took a conservative view of the purpose of education. He saw formal education as a systematic effort to construct human behaviour. The

teacher's role in this effort was similar to that of an architect or engineer. The teacher imposed shape or form on the student's behaviour. "The behavior of the student," according to Skinner (1968), "can in a very real sense be constructed" (p. 4). Teaching is largely a matter of arranging contingencies of reinforcement in order to shape desired habits of conduct. "Education is primarily concerned with the transmission of culture, and that means the transmission of what is already known" (p. 110). No culture is any stronger than its capacity to transmit itself. "It must impart an accumulation of skills, knowledge, and social and ethical practices to its new members. The institution of education is designed to serve this purpose" (p. 110).

Skinner (1968) was opposed to the use of the discovery method in teaching. Though arriving at concepts on their own may prove to be interesting to the students, "it is impossible to learn very much science in this way" (p. 110). Skinner believed it was dangerous to forgo teaching important facts and principles in order to allow students to stumble onto such information for themselves. "Great thinkers build upon the past; they do not waste time in rediscovering it" (p. 110). The prudent teacher sees that students master what it is they are supposed to learn.

Skinner's psychology grew out of the laboratory experiments he conducted with pigeons and rats. The Skinner box – a rat standing and pressing a lever in order to receive reinforcement – is symbolic of his mechanistic model of learning. Skinner believed the simple (animal behaviour) could be used to explain the complex (human behaviour). This purpose – to show that what is true for animals is equally true for humans – came to dominate the whole of his thinking.

Conclusion

Thinkers revel in building metaphorical castles in the air, sometimes even moving in and establish residence. Intellectuals have spent centuries erecting elaborate models. Today's scientific theories are merely the most recent examples of such mind-spinning activities. Before science, there was philosophy; and before philosophy, there was mythology. Joseph Campbell (1968), in *The Hero With a Thousand Faces*, tells us that "Religions, philosophies, arts, the social forms of primitive and historic man, prime discoveries in science and technology, the very dreams that blister sleep, boil up from the basic, magic ring of myth" (p. 3). Myth and metaphor furnish the raw materials used in model-building. Once constructed, however, models act as hypothesis generating systems from which answers to particular questions can be deduced.

Which model to choose? No model is inherently superior to any other model. Each model is designed to serve a particular purpose. The critical question is: what purpose does the model serve? Without a purpose, model-building

is a pointless activity. Take, for example, the three models under discussion. Montessori's pedagogy serves a spiritual purpose; Dewey's philosophy serves a humanistic purpose; and Skinner's psychology serves a behaviourist purpose. There is, however, a unifying question running through the writings of all three thinkers. *How* can humanity save itself? Though the question is the same, the answer proposed by the spiritual model differs from the one offered by the organic model as well as the one given by the mechanical model.

Maria Montessori had a lofty, mystical purpose in mind. The key to understanding her thinking is located in *The Secret of Childhood*. The child, she informs us, is a "spiritual embryo" whose development is guided by an inner power. The work of the child is to construct the personality of the adult. Montessori quoted approvingly Wordsworth's saying: "The Child is father to the Man." How does the child know which personality characteristics to borrow from his or her parents? The child's choices are guided by an inner light. Why does the child frequently take the wrong path?

Unfortunately, the home environment stifles his or her proper development. "The child," Montessori (1970) informs us, "has not been able to actualize his primitive plan of development because of the hostile environment he encountered in his formative period" (p. 189). How can the child be placed on the right path? Montessori believed in the virtue of work. By allowing the child the freedom to work his (or her) way through the Montessori curriculum, the damaged child can reconstruct himself (or herself). "The child," according to Montessori (1995), "is the spiritual builder of mankind, and obstacles to his free development are the stones in the wall by which the soul of man has become imprisoned" (p. 221).

Dewey was a thoroughgoing naturalist, who left no room in his system for a God (at least not in the usual sense). Dewey offers a humanistic answer to the question: How can humanity save itself? Though his thinking is scattered throughout his many works, Dewey's (1955) most direct answer is located in *A Common Faith*. Science, Dewey tells us, has become the *Novum Organum* for the modern mind. "There is but one sure road of access to truth—the road of patient, cooperative inquiry operating by means of observation, experiment, record and controlled reflection" (p. 32). Because of the growth of modern science, formal religion is dying on the vine. This has created a social problem. Though the passing of dogmatic religion is inevitable, what will happen to the religious quality of experience? The religious quality of experience offers a useful source of social motivation. Dewey argues that the religious quality of experience can be stripped from formal religion and fused with humanistic values. "Any activity pursued in behalf of an ideal end against obstacles and in spite of threats of personal loss because of conviction of its general enduring value is religious in quality" (p. 27). What should we feel religiously about? "There is such a thing as faith in intelligence

becoming religious in quality" (p. 26). Science, democracy, and education comprise the holy trinity in Dewey's value system. They offer humanity its best hope for salvation. Taking a religious attitude toward society's highest values, Dewey (1955) asserts, "has always been implicitly the common faith of humanity. It remains to make it explicit and militant" (p. 87).

Skinner offers a behaviourist answer to the question: How can humanity save itself? The scientific method will show us the way. "We need not worry about the scientific way of life," Skinner (1967) assures us, "it will take care of itself" (p. 412). Skinner was interested in applying the principles he discovered in psychology to the improvement of the human condition. His utopian novel, *Walden Two*, is based upon the technique of operant conditioning (Skinner, 1961). Skinner believes humanity has reached the point where it needs to make an ultimate choice: Either the human species must change its ways or face the possibility of its own extinction. Humanity needs to gain control over its destructive tendencies. The question is not one of free will *versus* determinism. People have always been planned, though haphazardly. Society needs to systematically plan for the qualities it desires to see in future generations. Behavioural psychology can assist us in our experiment in social engineering. Behaviourism offers the techniques for conditioning out aggression and power-seeking, and it supplies the technology for conditioning in cooperation and rationality. "Man," Skinner (1967) tells us, "must now plan his own future and that he must take every advantage of a science of behavior in solving the problems which necessarily arise" (p. 411).

Which model to choose – spiritual, organic, or mechanical? Whatever choice we make will depend upon the purpose or aim we have in mind. All three thinkers – Montessori, Dewey, and Skinner – addressed themselves to the same question: How can humanity save itself? Montessori, using a spiritual model, provides a mystical answer. The child, after receiving a "normalized" education, will lead humanity into a bright new future. Dewey, building on an organic model, offers a humanistic answer. Society can reconstruct itself by using applied intelligence. Skinner, operating on a mechanical model, proposes a behaviourist solution to the problem. Humanity can remould itself through the application of operant conditioning. There we have it. The fat is in the fire. Everything comes down to a question of purpose. Effort without purpose is pointless; purpose without effort is fruitless. On this point, Santayana offers us some sagely advice: "Fanaticism consists in redoubling your efforts when you have forgotten your aim" (Bartlett, 1955, p. 806).

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