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“Architects of the Mechanical World View”

Every world view has its architects—those who sketch out the blueprint that the rest of us end up filling in. There were many preliminary drawings before the final plans for the Machine Age were agreed upon. By the middle of the eighteenth century all of the key elements of the mechanical paradigm had been carefully integrated into a unified schema. The world was ready to turn the switch on the Machine Age. The mechanical world view is a testimonial to three men: Francis Bacon, Rene Descartes, and Isaac Newton. After 300 years we are still living off their ideas.

Francis Bacon laid the groundwork for the machine paradigm with a savage attack on the world view of the ancient Greeks. His *Novum Organum*, published in 1620, was a masterful piece of propaganda. Bacon sneered at the collected works of Plato, Aristotle, and Homer as nothing but "contentious learning." The Greeks, he snapped, "assuredly have that which is characteristic of boys; they are prompt to prattle but cannot generate; for their wisdom abounds in words but is barren of works." Paean took stock of the Greek world view and concluded that, for all of its pompous claims, it had not "adduced a single experiment which tends to relieve and benefit the condition of man." Bacon saw the world with different eyes. He didn't want to sit around contemplating nature. He wanted to find a methodology for controlling it. For the Greeks, the science of learning was intended to ask the metaphysical *why* of things; Bacon on the other hand thought that a science of learning should be committed to the *how* of things. Now the true and lawful goal of the sciences is none other than, this: that human life be endowed with new discoveries and powers."

Some part of Bacon's *Novum Organum* read more like an inter-office memorandum than a classical philosophical tract. For example, how many times have we heard our boss tell us to start dealing with the world as it is, not with how we would like it to be? Well, the boss is most likely unaware of it, but he's quoting Francis Bacon, who argued that we should begin "building in the human understanding a true model of the world, such as it is in fact, not such as a man's own reason would have it to be." Bacon goes on to make it clear that a new method for dealing with the world is in order, one that can "enlarge the bounds of human empire, to the effecting of all things possible." The new method Bacon alludes to is the scientific method, an approach that would separate the observer from the observed and provide a neutral forum for the development of "objective knowledge." According to Bacon, objective knowledge would allow people to take "command over things natural—over bodies, medicine, mechanical powers and infinite others of this kind."

Bacon is the original no-nonsense pragmatist of the modern age. The next time you hear someone say to you, "Try and be objective" or "Prove it to me" or "just give me the facts," think of Francis Bacon. He started it all off in 1620 with what he believed was a better idea for organizing the world.

Bacon had barely opened up the door to the new world view when. Rene Descartes, a mathematician by trade, came barreling through to announce the new floor plan. Shortly thereafter, he was followed in hot pursuit by Isaac Newton, who brought with him all the tools necessary to open up shop and begin doing business.

Descartes was not a modest man. He knew a good idea when he saw it. One rather cold day, according to his biographers, he was confined to his room by the severe weather. And that's when the idea hit him. The key to understanding the world, to deciphering its hidden secrets, to controlling it for human purposes was to be found in one word: *mathematics*.

As I considered the matter carefully, it gradually came to light that all those matters only are referred to mathematics in which order and measurement are investigated, and that it makes no difference whether it be in numbers, figures, stars, sounds, or any other object that the question of measurement arises. I saw, consequently, that there must be some general science to explain that element as a whole which gives rise to problems about order and measurement. This I perceived was called universal mathematics. Such a science should contain the primary rudiments of human reason, and its province ought to extend to the eliciting of true results in every subject.

Descartes concluded with an observation that has since become the overriding axiom of the mechanics paradigm! "To speak freely, I am convinced that it [mathematics] is a more powerful instrument of knowledge than any other that has been bequeathed to us by human agency, as being the source of all things!" Here then was a man convinced, the first "true believer" in the mechanical world view. Descartes wasted no time in popularizing his revelation. By the time he died in 1650, his mathematical view of nature had become accepted by the best minds all over Europe.

Descartes had succeeded in turning all of nature into simple matter in motion. He reduced all quality to quantity and then confidently proclaimed that only space and location mattered. "Give me extension and motion," he said, "and I will construct the Universe." Descartes's mathematical world was tasteless, colorless, and odorless; it didn't ooze, drip, or spill. After all, what could be neater and more well behaved than algebra and geometry? Mathematics represented total order, and so in a single stroke of genius Descartes had successfully eliminated everything in the world which might in any way be thought of as messy, chaotic, and alive. In Descartes's world everything had its place and all relationships were harmonious. The world was one of precision, not confusion.

The Greek view of history as unfolding chaos and decay was deemed unmathematical and therefore false. The Christian world view fared little better. How could one ever know the workings of the natural order with precision if a personal God was constantly intervening in the affairs of life? In order to work as a world view, the mechanical paradigm had to be, above all, completely predictable. There was no room for a Divinity who could change the operating rules whenever He chose. God, then, was delicately retired from the scene. Of course, at first He was congratulated for being the supreme mathematician who had engineered the whole plan and set it in motion, before going on to some other activity in the cosmic theater. Eventually, God was forgotten altogether, as succeeding generations became more and more intoxicated with the power this new-found paradigm provided them with.

Descartes gave human beings the "faith" that they could unravel the truths of the world and become its masters. Newton then provided them with the tools they needed to do it. Newton discovered the mathematical method for describing mechanical motion. He argued that one law could explain why the planets move the way they do and why a single leaf falls from the tree in the manner it does. Subjecting all of nature to the laws of mathematics, Newton

proclaimed that "all the phenomena of nature may depend upon certain forces by which the particles of bodies, by some causes hitherto unknown, are either mutually impelled toward each other, and cohere in regular figures, or are repelled and recede from each other." According to Newton's three laws, "A body at rest remains at rest and a body in motion remains in uniform motion in a straight line unless acted upon by an external force; the acceleration of a body is directly proportioned to the applied force and is the direction of the straight line in which the force acts; and for every force there is an equal and opposite force in reaction" Soon after Newton published his mathematical method it was being taught at all the major universities. His fame spread to every corner of Europe, and when he died in 1727 he was given a royal funeral.

The mechanical world view dealt elusively with material in motion, because that was the only thing that could be mathematically measured. It was a world view made for machines, not people. By separating and then eliminating all of the qualities of life from the quantities of which they are a part, the architects of the machine paradigm were left with a cold, inert universe made up entirely of dead matter. It was a short journey from the world as pure matter to the world of pure materialism, as we shall see in the next section.

Alfred North Whitehead delivered perhaps the single most devastating piece of commentary on the limitations of the Newtonian world machine as a historical paradigm. Noting that mechanics deals only with the space-time relationships of matter in motion, Whitehead remarked to his students:

As soon as you have settled... what you mean by a definite place in space-time, you can adequately state the relation of a particular material body to space-time by saying that it is just there, in that place: and, so far as simple location is concerned, there is nothing more to be said on the subject

The mechanical paradigm proved to be irresistible. It was simple, it was predictable, and above all it worked. Here, it appeared, as the long-sought-for explanation of how the universe functioned. There *was* an order to things, and that order could be ascertained by mathematical formulas and scientific observation. Still, as European scholars looked around them, they wondered why the normal activities of people in society often seemed so muddled and chaotic. The erratic behavior of people and the imperfect workings of government and the economy didn't seem to square with the well-ordered mechanical explanation of the world that Bacon, Descartes, and Newton had put forth. The dilemma was quickly resolved: if society was misbehaving, then it could only be due to the fact that it was not adhering to the natural laws that govern the universe.

The only thing that was needed, then, was to figure out exactly how the natural laws applied to human beings and social institutions and then apply them. Obviously, this would be a long and difficult process—but no longer an impossible one, because the universal laws were now known. Besides, it would be well worth the time and effort, since the final payoff would be a perfectly ordered society. Humanity now had a new purpose in life. Gone was the medieval goal of seeking salvation in the next world. In its place was the new idea of seeking perfection in this world. History was now seen as a progressive journey from the rather disordered and confused state that society found itself in to the well-ordered and wholly predictable state represented by the Newtonian world machine.

Two men immediately set about the task of discovering the relationship between these universal laws and the workings of society. John Locke brought the workings of government and society in line with the world machine paradigm, and Adam Smith did the same with the economy.

Like most intellectuals of his period, Locke was deeply impressed with how the mechanical model had made sense out of a seemingly incomprehensible natural world. But why, he asked himself, were the affairs of human beings so chaotic? The answer, he concluded, was that the natural laws of society were being violated because the social order was built upon irrational traditions and customs that originated from the theocentrism that had ruled the world for so long. With the aid of reason, Locke set out to determine the "natural" basis of society. He immediately concluded that religion could not form the social foundation simply because, by definition, God is unknowable. How can the unknowable be the proper basis for government? And so, in a monumental break with his philosophical predecessors, Locke argued that while religion could rightly be a private concern of each person, it could not serve as the basis of public activity

Having removed God from the affairs of people as Bacon had removed Him from nature—Locke was left with human beings, all alone in the universe. No longer was the human being to be considered as part of a divinely directed organism. Now, men and women became just what Bacon, Descartes, and Newton had made of nature: mere physical phenomena interacting with other bits of matter in the cold, mechanical universe. This being the case, on what basis could a social order be formed? Here Locke provided an argument that has continued to dominate the modern world view down to the present. Once we cut through useless custom and superstition, argued Locke, we see that society, being made up solely of individuals creating their own meaning, has one purpose and one purpose only: to protect and allow for the increase of the property of its members. Pure self-interest thus becomes, in Locke's formulation, the sole basis for the establishment of the state. Society properly becomes materialistic and individualistic because, Locke maintains, reason leads us to conclude that this is the natural order of things. By the laws of nature, each individual is called upon to act out his role of social atom, careering through life attempting to amass personal wealth. There is no value judgment to be made here; self-interest is simply the only basis for society.

For Locke, the purpose of government was to allow people the freedom to use their new-found power over nature to produce wealth. Thus, from Locke's time to our own, the social role of the state has been to promote the subjugation of nature so that people might acquire the material prosperity necessary for fulfillment. "The negation of nature," Locke declared, "is the way toward happiness." People must become "effectively emancipated from the bonds of nature."

But won't this constant and unmoderated scramble for personal affluence result in a savage war of each person against the other, with some members of society victimized in the process? Not at all, says Locke, for human beings are not naturally evil or fallen, but inherently good. It is only scarcity and lack of property that make them evil. As people are naturally acquisitive, it is therefore only necessary to continue to increase the wealth of society and social harmony will continue to improve. People need not fight among themselves because nature has "still enough--and as good left; and more than the unprovided could use." People can have liberty of action because their self-interest would not conflict with others. Locke, then, became the philosopher of unlimited expansion and material abundance.

Still, are there no limits at all to the amount of wealth individuals can amass? After all, philosophers from Aristotle to Aquinas had argued that, beyond a certain point, property becomes a barrier to happiness. Not so, argues Locke. In a state of nature, he admits, it is true that primitives can only accumulate a limited amount of property from the bounty of nature. If a primitive attempts to take more property than his crude knowledge will allow him to consume, then it will spoil and possibly rob other members of the community of their own chance for accumulation. But in a commonwealth founded upon reason, where money as a medium of exchange exists, an unlimited amassing of property is permissible, indeed natural, for that is the purpose of money. Since money cannot possibly spoil, it is impossible to possess too much of it. Obviously, some individuals will amass more property than others, but this too is natural, for the world was given to "the use of the industrious and rational." He who applies reason the best will benefit the most. Locke does not stop here, The ownership of property (value extracted from nature) is not only a right in society; there is also a duty to generate wealth. In an environmentalist's nightmare, Locke writes that "land that is left wholly to nature is called, as indeed it is, waste." Nature is only of value when we mix our labor with it so that it will be productive:

He who appropriates land to himself by his labour, does not lessen but increases the common stock of mankind. For the provisions serving to the support of human life, produced by one acre of inclosed and cultivated land, are... ten times more than those which are yielded by an acre of land, of an equal richness lying waste in common. And therefore he that encloses land and has a greater plenty of the conveniences of life from ten acres than he could have from a hundred left to nature, may truly be said to give ninety acres to mankind.

Using this early version of the "trickle-down theory" (the more one individually makes, the more society collectively benefits), Locke goes on to declare that a person should "heap up as much of these durable things (gold, silver, and so on) as he pleases; the exceeding of the bounds of his just property not lying in the largeness of his possession, but the perishing of anything uselessly in it." Reading Locke from our present-day concern with ecology, one has the unnerving feeling that he would not be satisfied until every river on earth were dammed, every natural wonder covered with billboards, and every mountain turned into rubble to produce oil shale. So rigidly productivist and materialistic is Locke that he condemns American Indians as a handful of people living in one of the richest lands in the world, idly refusing to exploit their riches; "A king of a large and fruitful territory there feeds, lodges and is clad worse than a day-laborer in England."

With Locke, the fate of modern man and woman is sealed. From the time of the Enlightenment on, the individual is reduced to the hedonistic activities of production and consumption to find meaning and purpose. People's needs and aspirations, their dreams and desires, all become confined to the pursuit of material self-interest.

Like Locke, Adam Smith was enamored of the mechanical world view and was determined to formulate a theory of economy that would reflect the universals of the Newtonian paradigm. In *The Wealth of Nations*, Smith argues that, just as heavenly bodies in motion conform to certain laws of nature, so too does economics. If these laws are obeyed, economic growth will result. But government regulation and control of the economy violated these immutable laws by directing economic activity in unnatural ways. Thus markets did not expand as rapidly as they could and production was stifled. In other words, any attempt by

society to guide "natural" economic forces was inefficient, and for Adam Smith, efficiency in all things was the watchword.

An inquiry into the laws of economics, Smith declared, will lead us to the inevitable conclusion that the most efficient method of economic organization is laissez-faire—the notion of leaving things alone and allowing people to act unhindered. Smith, like Locke, believed that the basis of all human activity is material self-interest. Since this is natural, we should not condemn selfishness by erecting social barriers to its pursuit. Rather, we should recognize people's desire to satisfy themselves for what it is—a virtuous activity that, in fact, benefits everyone. It is by each individual operating selfishly that scarcity may be overcome by surplus:

Every individual is continually exerting himself to find out the most advantageous employment for whatever capital he can command. It is his own advantage, indeed, and not that of society which he has in view. But the study of his own advantage naturally or rather necessarily, leads him to prefer that employment which is most advantageous to the society.

Smith explicitly removes any notion, of morality from economics, just as Locke had done with social relations. Any attempt to impose morality on economy simply leads to a violation of the "invisible hand," which Smith asserted was a natural law that governs the economic process, automatically allocating capital investment, jobs, resources, and the production of goods. People could use reason to understand this law, Smith allowed, but just as human beings cannot control gravity, they cannot improve on the invisible hand. Since nothing can be more efficient than this "natural" force controlling the rational market, wealth can best be produced only through free, unfettered trade and competition among rational, acquisitive individuals. Because the purpose of economics is a continually expanding market, anything that promises growth is to be welcomed.

Believing that men and women are basically egoists in pursuit of economic gain, Smith's theories subordinate all human desires to the quest for material abundance to satisfy physical needs. There are no ethical choices to be made, only utilitarian judgments exercised by each individual pursuing self-interest.

Bacon, Descartes, Newton, Locke, and Smith were the great popularizers of the mechanical world view. Many others preceded and followed there. Still, their basic assumptions remain with us today. Those assumptions can be summarized in a few short sentences. First, there is a precise mathematical order to the universe that can be deduced from an examination of the motions of the heavenly bodies. Unfortunately, here on earth most things in the primal state are in a chaotic and confused condition. Therefore, things need to be rearranged to bring the same order to our world as appears to exist in the rest of the cosmos. The question then arises as to how best to arrange the stuff of nature so that it reflects the same kind of order that exists in the universe. The answer, it was assumed, was to use the scientific principles of mechanics to rearrange the stuff of nature in a way that best advanced the material self-interests of human beings. The logical conclusion to this grand new paradigm was simply this: The more material well-being we amass, the more ordered the world must be getting. Progress, then, is assumed to result in an ever more ordered world. Science and Technology are the tools for getting the job done. This, in a nutshell, is the chief operating assumption of the mechanical world paradigm.

The mechanical world paradigm has not been without critics over the years. It has been ridiculed, attacked, and battered from many different quarters. Some of its assumptions have even been modified. Still, when one rereads Descartes, Locke, or Smith, one can't help but be impressed with how contemporary they sound. Every time a businessman, politician, or scientist speaks out in public on some pressing issue it's as if his speech had been ghostwritten by these long-dead seminal thinkers. Therefore, if the pronouncements tendered by our civic and public leaders seem more and more divorced from reality and less capable of explaining the problems facing our society, the blame isn't altogether theirs. If we're going to place the blame somewhere, then we should place at least part of it on Descartes, Locke, Smith and their colleagues. After all, it's their methodology and ideas we're using.

The mechanical world paradigm experienced its greatest triumph in the aftermath of Charles Darwin's publication of *On the Origin of Species* in 1859. Darwin's theory of biological evolution was every bit as impressive as the scientific discoveries of Newton in physics. It could well have pushed the mechanical world view off center stage and claimed hegemony for itself as a completely new organizing principle for society. It never happened. Instead Darwin's theories became an appendage to the Newtonian world machine. The full implications of Darwin's discoveries were never really explored. Instead, some of the more superficial trappings of his theory were immediately taken hold of and exploited in a way that further legitimized the mechanical world view.

Social philosophers like Herbert Spencer seized on Darwin's theory of the evolution of species as a kind of proof positive of the existence of progress in the world. Spencer and the so-called social Darwinists turned the concept of natural selection into the concept of survival of the fittest. In so doing, they provided further support for the mechanical world view that holds that self-interest leads to increased material well-being, which leads to increased order.

Survival of the fittest was interpreted to mean that in the state of nature, each organism is engaged in a relentless battle with all other creatures. Those who survive and pass on their traits to their offspring are simply those best able to protect their own material self-interest. Evolution itself was seen as a process of ever-increasing order brought about as a result of each succeeding species' being better equipped to maximize its own self-interest and provide for its material needs. And so, Darwin's theory became a complete regurgitation of the chief assumption of the mechanical world view.

The mechanical age has been characterized by this notion of progress. Reduced to its simplest abstraction, progress is seen as the process by which the "less ordered" natural world is harnessed by people to create a more ordered material environment. Or to put it another way, progress is creating greater value, out of the natural world than what exists in its original state. Science, in this context, is the methodology by which people learn the ways of nature so that they can, reduce them to consistent principles or rules. Technology, in turn, is the application of these rules in specific instances, the purpose being, to transform parts of the natural process into workable forms of greater value, structure, and order than exist in the primal state.

The mechanical world view, the world view of mathematics, science, and technology, the world view of materialism and progress, the world view that claims to explain the world we experience, is beginning to lose its vitality because the energy environment upon which it was nourished is nearing its own death. (This argument will be examined later on in detail.) If there is a history to look back on, future generations will shake their heads in

disbelief at the 400 years we call the modern age. The world as a machine will appear as naive to them as the Greeks' five ages of history have appeared to us. For They will be living under-an entirely new world paradigm, one whose broad contours we will now explore.