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**A Balanced Account of the
World: A Critical Look at
the Scientific World View**

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The origin of modern science in the 16th and 17th centuries corresponds with the origins of modern capitalism and the industrial system. From the beginning, the worldview and methods of science have fit in perfectly with the need of the capitalist social system to dominate nature and the vast majority of human beings. Francis Bacon made it clear that science was not an attempt to understand nature as it is, but to dominate it in order to twist it to the ends of humanity — in this case meaning the current rulers of the social order. In this light, science must necessarily be subjected to social analysis by anyone claiming to call the present social reality into question.

Science is not simply a matter of observing the world, experimenting with its elements and drawing reasonable conclusions. Otherwise, we would have to recognize children, so-called primitives and a good many animals as excellent scientists. But the practical experiments carried out by all of us every day lack a few necessary factors, the first and most important of which is the concept of the universe as a single entity operating under universal, rational, knowable laws. Without this foundation, science cannot operate as such.

Of course, the idea of universal natural laws had already come into existence in ancient Greece, arising at about the same time as written law for governing the city-states and money-based commerce. But the ancient Greek perspective differed significantly from that of modern science. The universal natural laws of Greek philosophy were fundamentally relational, parallel to the political and economic institutions of ancient Greek society. Thus this conception tended to promote moderation — Aristotle’s “golden mean” — and an avoidance of hubris, traits that very clearly do not find their equivalent in the modern scientific perspective.

Between the time of the ancient Greek philosophers and the origin of modern science, two significant historical events affected the western view of the world. The first of these was the rise of the Christian religion as the central dominating factor in western thought. This worldview replaced the concept of a multiplicity of gods who were part of the world with that of a single god external to the universe who created it and controls it. It additionally declared that the world had been created for the use of god’s favored creature, the human being, who was to subdue and rule it. The second significant event was the invention of the first automatic machine to play a significant role in public social life: the clock. The full significance of the invention of the clock in the development of capitalism, particularly in its industrial form, is a tale in itself, but my concern here is more specific. By materializing the concept of a non-living thing that could nonetheless move on its own for the populace, the clock gave an understandable basis for a new conception of the universe. Together with the idea of a creator external to the universe, it provided the basis for perceiving the unity of the universe as a clockwork created by the great clockmaker. In other words, it was essentially *mechanical*.

So religion and a technological development laid the basis for the development of a mechanistic view of the universe and with it of modern science. Recognizing the importance of religion in providing this ideological framework, it should come as no surprise that most early scientists were ecclesiastics, and that the sufferings of Galileo and Copernicus were exceptions to the rule, useful in developing the mythology of science as a force of truth fighting against the obscurantism of superstition and dogma. In reality, the early scientists were generally working for one or another of the various state powers as integral parts

of the power structure, following the same path as one of the best known among them, Francis Bacon, who had no problem with reporting people like Giordano Bruno, who expressed ‘heretical’ ideas, to the church authorities.

But the scandals of science, like those of the church, the state or capital, are not the substance of the problem. The substance lies in the ideological foundations of science. Basically relational views of the universe — whether the legalistic one of the ancient Greek or the more fluid views of people who lived outside civilization — imply that an understanding of the universe would come from attempting to view it as holistically as possible in order to observe the relationships between things, the connections and interactions. Such a viewpoint works well for those who have no desire to dominate the universe, but rather only want to determine how to interact with their environment in order to fulfill their desires and create their life. But the capitalist need for industrial development required a different worldview.

If the universe is a machine and not an interrelationship between a myriad of beings, then one does not achieve an understanding of it through simple observation and direct experimentation, but through a *specialized form* of experimentation. One cannot come to an understanding of how a machine works simply by observing it as it functions in its environment. One needs to break it down into its parts — the gears, the wheels, the wires, the levers, etc. — in order to figure out what each part does. Thus, a foundational aspect of the method of modern science is the necessity of breaking everything down into its parts, with the aim of achieving the most basic unit. It is in this light that one can understand why scientists think that it is possible to learn more about life by cutting a frog open in a laboratory than by sitting by a pond observing frogs and fish and mosquitoes and lily pads actually living together. The knowledge science pursues is quantitative knowledge, mathematical knowledge, utilitarian knowledge — a type of knowledge that transforms the world into the machine it claims the world is. This sort of knowledge cannot be drawn from free observation in the world. It requires the sphere of the laboratory where parts can be experimented with outside of the context of the whole and within the framework of the ideological foundations of mathematics and a mechanistic worldview. Only parts that have been separated in this way can be reconstructed to meet the needs of those who rule.

Of course, the first parts that must be separated from this mechanistic whole are the scientists themselves. The factor that makes the experiments of animals, children, non-civilized people and untrained people within the modern world unscientific is our lack of so-called objectivity; we are too involved, still in intimate relationship with that with which we experiment. The scientist, on the other hand, has been trained to place himself outside of that on which she experiments, to use the cold rationality of mathematics. But this objectivity is really no different from the separation of a king, an emperor or a dictator from the people they rule. The scientist cannot step out of the natural world in any literal sense which would allow him to view it from beyond its borders (for all practical intents and purposes, this universe has no borders). Rather like an emperor from the heights of his throne, from her laboratory the scientist proclaims to the universe: “You will submit to my commands.” The scientific worldview can really only be understood in these terms. The conceptions of the nature of the universe that have been put forth by modern science have not been so much descriptive as prescriptive, edicts proclaiming what the natural world must be

forced to become: mechanical parts with regular, predictable motions which can be made to function as the ruling class that funds scientific research desires. It should come as no surprise then that the language of science is the same as the language of the economy and of bureaucracy, a language devoid of passion and any concrete connection to life, the language of mathematics. What better language could one find for ruling the universe — a language that is at the same time utterly arbitrary and utterly rational?

So modern science developed with a specific purpose. That purpose was not the pursuit of truth or even knowledge except in the most utilitarian sense, but rather the atomization and rationalization of the natural world so that it could be broken down into its component parts which could then be forced into new, regularized, measured relations useful to the development of technological systems that could extract more and more components for the reproduction of these systems. After all, this was what the rulers wanted, and they were the funders (and thus financially the founders) of modern science.

With the mathematization of all things, what is singular in each thing disappears, because what is singular is beyond abstraction and therefore beyond mathematics. When that which is singular in beings and things disappears, the basis for passionate relations, relations of desire, disappears as well. After all, how does one measure passion? How does one calculate desire? The domination of instrumental reason has little room for any passion other than that deformed sort of greed that seeks to accumulate more and more of the standardized, commodified items available on the market and the money that makes them all equal in the strictest mathematical sense.

The various classification systems of science — which parallel systems used by state bureaucracies — certainly played a significant role in excluding the singular from the realm of science. But science uses another more insidious and irreparable method for destroying the singular. It attempts to break every thing down into its smallest possible components — first those units that are shared by every entity of a particular type, and then those that are shared by every entity that exists — because mathematics can only be applied to homogeneous units, units that can be equivalent. If early scientists had a tendency to experiment frequently with dead animals, including humans, it was because in death one dog or one monkey or one human is very much like any other. When pinned on a board in a laboratory with their bodies cut open, have not all frogs become equivalent? But this does not yet break things down adequately. Certainly such experimentation, whether with dead organisms or with non-organic matter allowed science to break the world down into components it could mold to fit into its well-measured, calculated, mechanistic perspective, a necessary step in the development of industrial technology. But mathematics and the corresponding mechanistic worldview were still quite clearly ideas that were being imposed on an unwilling and resistant world — particularly (or maybe just most noticeably) the human world, the world of the exploited who did not want their lives measured out in hours of work timed by the industrially accurate clocks of the boss, the exploited who didn't want to spend every day in the same repetitive task that is also being carried out by hundreds — or maybe thousands — of others in the same building, or one that is identical to it in order to earn the general equivalent for buying survival.

Physics has always been the science in the forefront of the effort to make mathematics the inherent basis of reality. If one is to believe the myth, when

the apple hit Newton on the head, it supposedly led him to come up with equations to mathematically explain the attraction and repulsion of objects. For some reason, this is supposed to make us think of him as a genius rather than a petty-minded, calculating businessman/scientist. (He was a stockholder in the famous East India Company which provided the financial basis for so many of Britain's imperialistic endeavors and head of the Bank of England for a time.) But Newton's law of gravity, Galileo's law of inertia, the laws of thermodynamics, etc. come across as mathematical constructs of the human mind that are imposed on the universe, just as their technological results — the industrial system of capitalism — was an imposition of this rationalized worldview into the daily lives of the exploited classes.

It should be clear from this that the scientific method was never the empirical method. The latter was based only on experience, observation and experiment *within* the world with no preconceptions, mathematical or otherwise. The scientific method, on the other hand starts from the necessity of *imposing* mathematical, instrumental rationality on the universe. In order to carry out this task, as I have said, it had to separate specific components from their environment, remove them to the sterility of the laboratory and there experiment with them in order to figure out how to conform them to this instrumental, mathematical logic. A far cry from the sensual exploration of the world that would constitute a truly empirical investigation.

Modern science has been able to continue developing not because it opens the way to increasing knowledge, but because it has been successful at carrying out the task for which the state and the ruling class funded it. Modern science was never intended to provide real knowledge of the world — that would have required immersion in the world, not separation from it — but rather to impose a particular perspective on the universe that would turn it in to a machine useful to the ruling class. The industrial system is proof of the success of science at carrying out this task, but not of the truth of its worldview. It is in this light that we can examine the “advances” that constitute the “new physics” — relativity physics, atomic physics and quantum physics — because it is this post-Newtonian physics that succeeds in imposing the mathematical conception onto the universe to such a degree that the two come to be seen as one. In Newtonian physics, the universe is a material reality, a machine made up of parts the interactions of which can be “explained” (though, in fact, nothing is really explained) mathematically. In the “new” physics, the universe *is* a mathematical construct — matter simply being part of the equation — made up of bits of information. In other words, the “new” physics has a *cybernetic* view of the universe.

Relativity physics mathematizes the universe on the macrocosmic level. According to its theories, the universe is a “space-time continuum”. But what does this mean? The “space-time continuum” is, in fact, purely a mathematical construct, the multi-dimensional graph of a complex equation. Thus, it is completely beyond empirical observation — strangely like cyber-space. Or not so strangely, if one considers the former as a model for the latter. Once again, it matters little if this picture of the universe is true. It *works* on a technological and economic level, and that has always been the bottom line for science.

The “ultimate reality” that is the “space-time continuum” — this “reality” beyond our senses that the experts tell is more real than our daily experience (and who still doubts them in this alienated world?) — is constructed of bits of

information called *quanta*. This is the microcosm of the total mathematization of the universe, the realm of quantum physics. Quantum physics is particularly interesting for the way in which it exposes the project of modern science. Quantum physics is supposed to be the science of sub-atomic particles. At first, there were just three: the proton, the electron and the neutron. These explained atomic weight, electricity, etc. and allowed for the development of nuclear technology and modern electronics. But too many mathematical discrepancies appeared. Quantum physics has dealt with these discrepancies by using the most consistent scientific method possible; it has formulated new equations in order to calculate away the discrepancies and called these mathematical constructs newly discovered sub-atomic particles. Once again, there is nothing that we can observe through our senses — even with the aid of tools such as microscopes. We are dependent on the claims of experts. But experts in what? Clearly, they are experts in constructing stopgap equations that uphold the mathematical conception of the universe until the next discrepancy arises — functioning in a way that parallels capitalism itself.

Relativity physics and quantum physics are often passed off as “pure science” (as if such a thing has ever existed), theoretical exploration without any instrumental considerations. Without even considering the role these branches of science have played in the development of nuclear weapons and power, cybernetics, electronics, and so on, this claim is also belied by the ideological interests of power that they serve. Together these scientific perspectives present a conception of reality that is completely outside of the sphere of empirical observation. Ultimate reality lies utterly beyond what we can sense and exists completely within the sphere of complex mathematical equations that only those with the time and education — that is the experts — are capable of learning and manipulating. Thus the “new” physics — like the old, but more emphatically — promotes the necessity of faith in the experts, of acceptance of their word over one’s own perception. Furthermore, it promotes the idea that reality consists of bits of information that are connected mathematically and can be manipulated at will by those who know the secrets, the sorcerers of our age, the scientist-technicians.

Relativity and quantum physics have succeeded in doing what every branch of science would like to do; they have completely separated their sphere of knowledge from the realm of the senses. If reality is only a complex mathematical equation made up of bits of information, then thought experiments are certainly at least as reliable as experiments on material objects. It should be evident by now that this has been an ideal of modern science from the beginning. The separation of the scientist from the sphere of daily life, the sterile laboratory as the realm of experimentation, the blatant scorn of the early scientists for daily experience and what is learned through the senses alone are clear indications of the attitude and direction of science. For Bacon, for Newton, for modern science as a whole, the senses — like the natural world of which they are a part — are obstacles to be overcome in the pursuit of dominance over the universe. Interacting with the world on a sensual level is much too likely to evoke passion, and the reason of science is a cold, calculating reason, not the passionate reason of desire. So the world of non-material experimentation opened by the “new” physics fits in well with the trajectory of science.

While some have tried to portray the concepts of relativity and quantum physics as a break with the mechanistic worldview held by science up to that

time, in fact, this “new” view of the world as pure mathematical construct made up of bits of information was precisely the aim of science. It developed its material manifestation in cybernetic technology. The industrial mechanistic worldview gave way to the far more totalizing cybernetic mechanistic worldview, because the latter serves the purposes of science and its masters better than the former. The development of cybernetic technology and particularly of virtual reality opened the door to the possibility of non-material experimentation for those branches of science for which this had previously been impossible, particularly the life sciences and the social sciences. This world doesn’t just provide a means of storing, organizing, categorizing and manipulating figures and information gathered during experimentation and research in the physical world; it also provides a virtual world in which one can experiment on virtual organic beings and systems, on virtual societies and cultures. And if the universe is nothing more than interchangeable bits of information in mathematical relationship to each other, then such experiments are on the same level as those carried out in the physical world. In fact, they are more reliable, since the obstacles of the senses and of the possible development of sympathetic emotion toward those upon which the scientist is experimenting do not come into play. No need to worry about the fact that anything mathematically calculable, and thus programmable, can happen in the virtual realm; this merely shows the infinite technological possibilities to be found in the manipulation of bits of information.

It is worth noting that the “discovery” of DNA occurred just a few years before the beginning of what some have called the “information age”. Of course, cybernetic and information technologies had existed for some time already, but it was in the early 1970’s that these technologies began to penetrate into the general social sphere to a great enough extent to be able to affect how people viewed the world. Since we have already been torn from any sort of deep, direct relationship with the natural world due to the exigencies of the industrial system, most of our knowledge of the world comes to us indirectly. It is not really knowledge at all, but *bits of information* accepted by faith. It is, therefore, not so difficult to convince people that knowledge really is nothing more than an accumulation of these bits and that reality is simply the complex mathematical equation that encompasses them. It is a very short distance from this to the genetic perspective that life is simply the relationship between bits of coded information. DNA provides the precise interchangeable bits that are the necessary basis for this and, thus, provides the basis for the digitalization of life.

As we have seen, science has never been simply an attempt to describe what exists. Rather it seeks to dominate reality and make it conform to the ends of those who hold power. Thus, the digitalization of life and of the universe has the express purpose of breaking everything down into interchangeable bits that can be manipulated and adjusted by those trained in these complex techniques in order to meet the specific needs of the ruling order. There is no place in this perspective for a conception of individuality made up of one’s body, one’s mind, one’s passions, one’s desires and one’s relations in an inimitable dance through the world. Instead, we are nothing more than a series of adjustable bio-bits. This conception is not without its social basis. Capitalist development, particularly in the last half of the 20th century, turned citizens (already *part* of the apparatus of the nation-state) into producer-consumers, interchangeable with all others in terms of the needs of the social machine. With the integrity

of the individual already shattered, it is not such a great step to transform each living thing into a mere storage bank for useful genetic parts, a resource for the development of biotechnology.

Nanotechnology applies the same digitalization to inorganic matter. Chemistry and atomic physics provided the conception of matter as constructed of molecules which are constructed of atoms which are constructed of subatomic particles. The goal of nanotechnology is the construction of microscopic machines on a molecular level that will ideally be programmed to reproduce themselves through the manipulation of molecular and atomic structures. If one accepts the impoverished conception of life promoted by genetic science and biotechnology, these machines would arguably be “alive”. If one examines some of the purposes their developers hope they will serve, it seems that they could, like spliced genes, function in the environment in ways very much like viruses. On the other hand, some of the descriptions of the auto-reproductive function that is to be programmed into them give the frightening idea of air-borne active cancer cells.

Both biotechnology and nanotechnology can evoke horrific visions: large and small scale monsters, strange diseases, totalitarian gene manipulation, microscopic air-borne spying devices, intelligent machines with no more need of their human dependents. But these potential horrors do not strike at the heart of the problem. These technologies are reflective of a view of the world drained of wonder, joy, desire, passion and individuality, a view of the world transformed into a calculating machine, the worldview of capitalism.

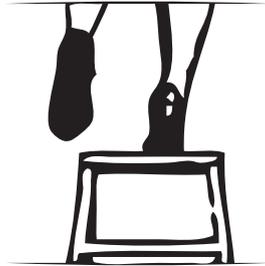
The earliest modern scientists were mostly devout christians. Their mechanical universe was a machine manufactured by god with a purpose beyond itself, determined by god. This conception of a higher purpose disappeared from scientific thought long ago. The cybernetic universe serves no other purpose than that of maintaining itself in order to maintain the flow of bits of information. On the social level where it affects our lives, this means that every individual is simply a tool for maintaining the present social order and can be adjusted as necessary to maintain the flow of information that allows this order to reproduce itself, information more precisely called *commodity exchange*.

And here the real function of science is revealed. Science is the attempt to create a system that can present a balanced account of all the resources in the universe, making them available to capital. This is why it must break the universe down into its smallest bits, bits that have a sufficient degree of identity and interchangeability to act as a general equivalent. This is why it must force the universe to conform to a mathematical construct. This is why ultimately a cybernetic model is best for the functioning of science. The real end of modern science from the start has been to render the universe into a great calculating machine that will render account of its own resources. So the function of science has always been to serve the economy and its development has been the search for the most efficient means of doing so. But the scientific accountants with their calculations, graphs, charts and ledgers are perpetually confronted with a recalcitrant reality comprised of entities that don't conform to numbers or measurements, of individuals who resist interchangeability, of phenomena that cannot be repeated — in other words, of things that incessantly unbalance the accounts. Scientists may attempt to retreat to the laboratory, to the thought experiment, to virtual reality, but beyond the door, beyond their minds, beyond the realm of cyberspace, the unaccountable still waits. So science,

like the capitalist social order it serves, becomes a system of stopgap measures, of perpetual adjustment in the face of a chaos that threatens to destroy the economy. The world envisioned by science — the one it proclaims to be real as it tries to create it through the most excruciating technological bondage and torture — is an economized world, and such a world is one drained of wonder, joy and passion, of all that will not be measured, of all that will not give an account of itself.

Thus, the struggle against capitalism is the struggle against modern science, the struggle against a system that strives to know the world merely as measurable resources with a price, as interchangeable bits of economic value. For those of us who seek to know the world passionately, who want to encounter it joyfully with a sense of wonder, different ways of knowledge are essential, ways that aim not at domination, but at pleasure and adventure. That it is possible to study and explore the universe in ways other than that of modern science has been shown by the reasonings of certain natural philosophers in ancient Greece, the knowledge of the sea of Polynesian navigators, the song-lines of Australian aborigines and the best explorations of certain alchemists and heretics like Giordano Bruno. But I am not interested in models but in the opening of possibilities, the opening to relations with the world around us that are without measure — and the past is never an opening; at best, it is evidence that what exists is not inevitable. A conscious rebellion of those who will not be measured could open a world of possibilities. It's a risk worth taking.

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