# And Yet It Moves (Updated Edition)

**The Realization and Suppression of Science and Technology**

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# Contents

## Preface c/o Endangered Phoenix

This small booklet was written in the 1980s just before the fall of the Berlin Wall and the subsequent collapse of the Soviet Union and its Stalinist influence throughout Eastern Europe. It was written because at the time I felt that we were at the beginning of a Second Scientific Revolution and that science and technology was governing all of our culture and that the left, as it then existed, had hardly debated the issues around it. Much of what was written was prophetic, though much has been dated by events. However, the central thesis is still valid. It was pointed out that the emerging openness of the then developing computer communication and the availability of data pointed to a weakness in the Soviet and Chinese monopoly of information. In the interim there has been an explosion in technological consumerism, the internet has taken off in a way which would have been difficult to predict at that time, while the growth of Frankenstein food and the manipulation of genes and cloning have provoked intense argument amongst scientists and in the media. There has been a growing distrust of genetically modified foods and this has led to multifarious direct action.

## Introduction c/o Endangered Phoenix

The original writing of the booklet was influenced heavily by the work of the Situationist International, (1957–72) whose work attempted to bring together various disparate critiques of modern life, from radical politics, through Art, Psychoanalysis and a critique of everyday life into a coherent analysis of the conditions of modern capitalism. It is still one of the most potent and damning critiques of capitalism around and if I still use these concepts it is because I believe that no modern critique of capitalism can succeed without taking it on board, by using and surpassing it, and not because of any sectarian loyalty to some cult of ideas. I am not a Situationist.

Over the past few years, since Seattle, passing through the various riots of Washington, London, Milan, Melbourne Seoul, Prague or Nice, tens of thousands of a younger generation of anti-capitalist youth throughout the globe have denounced, criticised and attacked "capitalist globalisation", "racism" , "genetically modified foods" as well as so-called "third-world sweat-shops" and probably, if all were known, much else besides. There is a new protest movement in the making, which has not had this much scope since the Margaret Thatcher's defeat of the Miners' Strikes in Britain in the 1980s. If, at times, the concepts used here (proletariat, class struggle) may seem outdated to some, I make no apology. If some people find an emphasis on abstract ideas, like history and theory, boring stuff maybe, it is only to help provide these movements of direct action with a theoretical base in which to proceed. They are still valid concepts even if they have been misused in the past. The defeats of former generations is the food for thought of the new generations; the ideal of Communism is not only Stalinism or what might exist in one country, election politics is a sham in a world of false choices and trust in the spectacular lyrics of a song-writer or trade-union or political-leader is merely the lie which digs our own graves. What is important here it is the new ideal of anti-capitalism, which starts from a collective spirit of what is wrong, which everywhere exists in spirit but is nowhere actual. Such poetry starts off in struggle and community, it is the collective poem and the collective struggle which takes its validity and creativity, not the individual careers of would-be-do gooders but out of the real needs of real people.

# The Death of Science

Society today, at the beginning of this third millennium, is merely a collection of dead spectacles which while promising a better future, merely ends up promoting more misery in the world. Of all the current spectacles, whether Art, Culture, the Good or Happy Life, the Tiger Economy, it is the world of Science and its technological society which is the least criticised. In a society where power is everywhere diffused and sometimes condemned, the appeal to science becomes some final authority. All that power need do to prove this or that little sociological point correct is to say that it is "scientific." From the justification of power as scientifically administered to the proof of the instability of that power, the last spectacular authority is always some appeal to science.

Science is a spectacle as well as a methodology of the spectacle and increasingly one of its main methodologies. It is the alchemy of technocrats who see their flowcharts and algorithms as beckoning a superior organisation of knowledge and power. "Power is knowledge,", the old adage goes, and scientific knowledge is the atomised theory which grants the power to modern technological capitalism. Science, from being the once revolutionary expression of the bourgeois class has become the spectacularised power which legalises, regularises and rationalises its pseudo-victories.

It is the methodology of technological capitalism, without appearing to be it's raison d"tre. It appears to contain within itself the power of rational justification, while being no more than the justification of that power. By being the logic of the irrationality of the spectacle it spectacularises rationality. By appearing to be rational, all it can do is to rationalise appearances. As the science author, Stephen Jay Gould, one of the more reasonable academics of science, has noted, "Science validates bias precisely by appearing to remove it."

Science is now attacked from all sides, not least from the common-sensical ecological viewpoint which rightly sees imminent disaster appearing on the horizon. Scientific bias has been challenged in every bar and every caf' in every part of the world, and for all sorts of reasons but the arguments are generally disputed on a level which even though no-one finally wins out, the contradictions raised are all logical and sensible but all disputed. Usually science today is criticised with some other version of science in mind, usually some science-fiction version.

Is this enough? This little pamphlet asks some deeper questions. Does the very structure of science, the way it defines its tasks and carries out its business, confine it to specific goals and applications? Could there be a completely different organisation of scientific method and, if there were, would it be still called science? These are some of the questions raised here. The answers will not suit everyone nor are they meant to. If this text appears unduly aggressive at times I make no apologies, because it is not difficult to feel aggression towards a society that unquestionably values science as one of its most sacred spectacles and which may even blow itself up or damage itself irrevocably (genetically or otherwise) by doing so.

In fairness, economically profitable research can often be socially useful. But the two are not synnomomous. Perhaps we should not be surprised that so much of what is called science is in fact marketing. We are bombarded with advertising which mentions unheard of and probably spurious chemical and biological compounds and processes for everything from cleaning clothes to removing wrinkles and boosting our immune systems. It was once called Snake-oil and most of the belief in it is still wishful thinking or even recklessness, bordering on religious thinking. It is the science of mass-psychology in which white coated test tube handling scientists are used as props for commodity promotion.

"The purpose of science," Robert Oppenheimer (1904–1967, the physicist charged with developing the Manhattan Project in Los Alamos which led to the development of the Atom Bomb) once said, "is no longer to differentiate between what is possible and impossible but between what is possible so as to determine what is ethical." Governments, like religions, follow this advice. The Pontifical Academy of Science, and its bureaucracy have more sway over the Pope than the entire College of Cardinals. Scientific advisors pontificate about stabilising and destabilising progress while advocating the pros and cons of policies. Governments call for more science to find out what is rotten in society. TV News and Chat Shows call in " scientific specialists" to explain government policy (on say genetic cloning or genetic patenting) to an otherwise ignorant public. Why is it that everyone places such high trust in Science?

In the last century, so much of western European science emigrated to the US and to a lesser degree to the Soviet Union. Between 1900–1933, the US won seven science Nobel prizes, between 1933 and 1970 it won 77. This is as much a testament to the strength of capitalism in the US as much as to its relationship with scientific research. If science fled fascism for the dollar to immerse itself into the "free market", capitalism needed this science and created the means whereby there was capital investment in it. There was a period of Big science, the Science Race, the Cold War, where science was seen as the measure of things. With the end of the Cold War the market is still open for grasps, now by Big business rather than Big Government. But with genetics having replaced physics as the "hottest" science, ever more people are becoming worried about this relationship between capital and scientific research. And with the emergence of the post-Seattle anti-globalisation movements more and more people are taking to the streets to demonstrate their concern.

The organisation of science and technology has become the Damocles sword of the denial of the totality of social relations as well as the logic of the dictatorship of constant capital. Science experiments with society. But there is very little that it can claim as progressive, as every piece of new knowledge is only to be used for the extraction of more profit. The drugs or gene research which could have helped physical discomfort or cure diseases might have been progressed long ago had creativity and not profit been the guide.

Some journalist (New Scientist) has estimated that over 500 branches of science exist at present. Pure Physics, once called Natural Philosophy in the seventeenth century, gave way to European Scientific Revolution (between 1650 and 1800) where speculative philosophy was replaced by an ever restricted field of observation, experimentation and rationality. With the quickening dissolution of traditional boundaries between the sciences, new sub-sciences were formed, but, unfortunately today sub-science wishes to restrict itself to its own little piece of the action and is so convinced of its own claustrophobic methods that it's like some modern-day academically trained Cremonino who wouldn't look through Galileo's telescope for fear of seeing something that might contradict him. One look outside the ivory tower, down to the street, might convince her otherwise.

Perhaps the greatest threat to science comes from technology. This might seem strange since technology is really just applied science. But it is the forms of technology that are most favoured by the market and its would-be heroic entrepreneurs which grab the media attention because they rope in the greatest profits and this feeds back into funding of science itself. Science, for all its championing of rationality, is still controlled by forces which are really anti-rational. Whether it is advertising the Teflon products of the mobile phones and palm-tops or whether it is the Pentagon advertising Armageddon, regional nuclear arms races or biological terrorism science has to be seen as a political subject and never more so when business pretends that it is not. It is not geeks and nerds that we have to fear — though we should fear them anyway — it's the business anoraks who alchemy will turn everyone into entrepreneurs and make all of us believe that science is beyond question, just because it scientific.

It is now considered "unscientific" and even dangerous to criticise science. The mythical equation of "scientific research" and the "organisation of knowledge" seems to make science impermeable to criticisms from anything than some other pseudo-science which claims more objectivity, more proof, more method, more science. It is the trap into which Mr Karl Marx fell. Marx was so agog with the Victorian idea of science and hoped to give the working class its own science, an idea which was repeated again by Stalin, himself somewhat of a science populariser which proved a scientific disaster when put into practise in Russia in the last century. What we are left with historically, is the miserable misunderstanding between Mr. Karl Marx and the anarchist Mr. Michael Bakunin, the distrust between a so-called scientific and utopian socialism. At the tragic expense of utopia.

This little booklet is an attempt at a brief discussion of the history of science, its origins and development through bourgeois society up to the present day. It tries to looks at certain changes in information, robotic, and genetic engineering technologies, as well as some of the theoretical premises behind them, and asks what's in it for the people who suffer the consequences of these experiments? It will look at the mythology behind the concept of Pure Science as well as the uses of Science, in informatic and genetic engineering, the Internet as well as the commodities it spawns. Some of the present-day myths such as the difference between pure and applied science and the manner in which scientific ideas are declared valid, are questioned. There is little concern here about whether some particular aspect of science has done humanity well (obviously it has) or has some internal structural beauty (and as someone trained in the sciences I can read Priestly as I read Wordsworth). While there may be an aesthetic quality to Einstein's theory of relativity, equal in its time (something C.P. Snow, in his Two Culture theory could never understand) to, say, Joyce's Ulysses, this sort of consideration is not what concerns us.

Nor is it a matter of the bad press or the severity and frequency of science's local disasters and accidents (Bhopal, India, 1984 or Chernobyl, the Ukraine, 1986 to name just two such more serious disasters- both of which affected poor people most), but of the very global concept of Science, a particular form of the production of ideas — Historical Science; Science with a capital S. While Karl Marx proclaimed the limits of philosophy and the Dadaists proclaimed the death of Art; what remains is to dare to look to a future where (to use the French poet, Lautreamont) "science would be made by all and not by one."

Thus it is not a question of bad versus good Science, and certainly not bourgeois versus proletarian Science. Let there be no illusion about it from the beginning. We are dealing with science as a particular historical form of the organisation of knowledge, the form of modern science as it arose with the development of capitalism and which will die or become merely a memory of these bad old days with the abolition of capitalism and the creation of a classless society. There is no alternative science, no more than there could have been a proletarian Art or a proletarian State, which are merely attempts to occupy the bourgeois terrain without abolishing it. Stalin showed what the proletarian state was and the concept of a proletarian science led disastrously to the abuse of power of Commissar Lysenko outlawing Mendel's theory of inheritance . Nor is there any "science for the people," which is merely the cultural massification of bourgeois values, an attempt to make little "scientists" of us all through the dogmatic adherence to certain scientific "givens" in schools and glossy scientific magazines.

# Chapter 1: A Little Bit of History

Most histories of science perpetuate the fiction that science has always been with us. They relate science to commerce and industry and work backwards from bourgeois society to find a relationship between science and society. In this way they try to falsify all of human history by positing the notions of bourgeois society (the particular modes of production of bourgeois society) as eternal (when really they are only as temporary as they are contradictory). They rarely look forward.

Activities such as healing, star-watching and engineering have been practised in many societies since ancient times. Pure science, especially Physics (formerly called Natural Philosophy) had traditionally been the main area of study for philosophers. The European scientific revolution replaced speculative philosophy with a newer methodology based on observation, experimentation and rationality. But this science which developed in the transition from feudalism to capitalism in the 16$^{th}$ century arose from a coalition of the needs of sections of that society and not out of the blue. It arose from the needs of artisans, merchants, bankers, machine-makers, those who wanted and needed to overthrow the scholastic restrictions on the practice of commerce. Here, in this transition, for the first time knowledge and theory were placed in a dominant position in the production and reproduction of capital through the manufacture of goods, to their transportation and the opening up of new markets and the protection of these markets through defence and warfare.

This science was never based on the ideal of knowledge for its own sake, as most present-day academics would have us believe. Such a goal is continual and is not related to any particular economy. What we refer to here is a search for knowledge which is based on profit. And those discoveries which could increase profit were the ones deemed interesting and worthy of further research and financing. This is what someone like Georgeo de Santillana could never understand in 2000 pages of his work, in which his "Origins of Scientific Thought" (1961) must occupy an especially asinine position. Even Crombie's ridiculous book, "Augustine to Galileo" (1952), is a special example of such hackneyed historians of continuity. Perhaps it was Koyr' who began to understand the importance of what took place beginning in the 14$^{th}$ century when he wrote ("Galileo to Plato": Journal of the History of Ideas, 1957): "What they had to do was not criticise and combat faulty theories. They had to do something different. They had to destroy one world and replace it by another. They had to replace the framework of the intellect itself, to restate and reform its concepts, to evolve a new approach to Being, a new concept of knowledge, a new concept of science and even to replace a pretty natural approach, that of common sense, by another which is not natural at all." Another person who had made this point, though earlier and perhaps more forcefully, was Edgar Zilsel, a German 'migr' to the U.S. in the 40s. His "Sociological Roots of Science" (1942), as most of his work, is largely ignored today.

Most of the academic historians, while they may be useful for detailed study of specific documents and periods, are involved in what we could call (to misuse T.S. Kuhn) "normal" science history. They mystify science by extracting it from the totality of what was going on at the time and thereby perpetuate fictions as to what its importance really was.

The first secular rebellions against priestly-feudal learning were represented by ex-secretaries and officials of municipalities who had lost their official connection to become the so-called free literati of that time, hiring themselves out to whomsoever would take them on; nobility, merchants, and bankers alike. Just like many of those who preceded them, they were stylists, more influenced by neo-Greek classicism, where the striving after a perfection in style and the accumulation of classical knowledge was of foremost importance with no regard to scientific method or causal relations. They were forced to share the social prejudices of the nobility which patronised them, disdaining manual work and anyone who did it, in keeping with the Greek stylists. It is said that Archimedes felt ashamed at being asked to build battering rams as it was too much like manual work, and Aristotle once said that women had more teeth than men. Seemingly, he had never looked. Writing and speaking in Latin, these free literati retained the classical distinction between liberal and mechanical arts, between mind and hand, between intellectual and doer, a distinction which was only to be modified but not destroyed by bourgeois society, one which we still live today.

Surgeons at that time, who carried out dissection work, were in the same class as barbers and midwives, while artists were no different from white-washers or stone dressers and, like all serious craftsmen, had to belong to guilds. This was still the situation at the time of De Vinci in 1500. They did not become detached from handicrafts until the $16^{th}$ century, when they began to claim a different status through such arguments as that painting required a knowledge of geometry and perspective. It is generally forgotten these days that the modern concept of the artist is really a recent invention. That the scientist is also is adamantly denied.

The first technical works were penned by craftsmen: Biringuccio's "De La Pirotechnia" (1540), Agricula's "De Re Metallica" (1556), and Ercker's "Beschreibung" (1574). Biringuccio's pamphlet is one of the first chemical treatises free of alchemist speculation, while Durer wrote reviews (even manifestos) on descriptive geometry and fortifications. These craftsmen wrote in the vernacular and not in Latin, and they arrived at their conclusions through practical work. They wrote down what they observed, sometimes even in code, so as to protect their peculiar technology as much as to protect their own little hierarchy. Such pioneers of empirical scientific observation were workers and artisans; mariners, shipbuilders, carpenters, foundrymen and miners who worked silently and steadily on the advances of technology, giving us the compass, paper-mills, explosives, wire-mills, and blast-furnaces, and introducing machinery into mining. Most were uneducated, often illiterate, and most of the names from this period are unknown to us. The scholastics and the prattling humanists had little to communicate to them, had they even been able to read them.

They had no idea how to proceed systematically, so therefore trial and error and the rule of thumb had to be the guiding principles. Yet they were forming the groundwork for what later would be known as mechanics, acoustics, anatomy, astronomy, metallurgy, and chemistry. They were only craftsmen and not scientists as such, so the limitations of craft organisation and its guild mentality ruled. But, as bankers and merchants began to realise the potential wealth of the information and skills they possessed, the status of craftsman was raised; artists and scientists were emerging as respectable professions.

In those days intellect was left to the nobility — while observation and experimentation was left to the artisans. Even as late as 1697, a Dr. John Wallis is quoted (Mathematical Practitioners of

Tudor and Stuart England, Taylor, 1954) as writing: "Matematiks were at that time scarce looked upon as academic studies, but rather Mechanical; as the business of Traders, Merchants, Seamen, Carpenters, Surveyors of land and the like." The first chairs in Astronomy and Natural Philosophy were established in Oxford only in 1619 and that of Mathematics at Cambridge in 1663, — where Newton would be the second occupant.

The increased power of the merchants and bankers were at odds with the classical universities and what was being taught there. Maybe Galileo and Francis Bacon best exemplify this. When Galileo studied medicine at the University of Pisa, mathematics was not taught there and he had to take a course privately. When he moved to the University of Padua he set up a "university laboratory" in his own home, the first of its kind in history, spending much of his time visiting and talking with tradesmen of all skills and inviting them to his home. His Discorsi is one of the first books to use both Latin and Italian (Latin for mathematical deductions, Italian for arguments and propaganda). Feyerabend correctly cites this eloquence in Italian as a key factor in the forcefulness of his arguments and as an example of how science progresses through subterfuge, rhetoric, and propaganda rather than the ideals of pure rationality. Calling up a whole reservoir of everyday experience taken from visits to the docks and what he learned from tradespeople he was able to solidify his arguments against the virtuosi and literati by insinuating that the reader had been familiar with his arguments all along. His books were popular because people could have them read to them and because they represented a popular yearning to ridicule the intellectuals. Galileo is in many respects the first bourgeois scientist.

England was to become the home of the first bourgeois revolution and things progressed more clearly there. Although William Gilbert was to be physician to Queen Elizabeth, he was able to write a book on magnetism (De Magnate, 1600) based entirely on laboratory experimentation and observation. His methods derived more from foundrymen and miners with whom he had personal contact. Most of his work was plagiarised from the work of the retired seaman Robert Norman, in any case, but Gilbert's importance was that he helped pave the way to a compromise between the aristocracy and the rising bourgeoisie in Britain, a compromise which was to last up to the present day.

Bacon, however, best exemplifies the bourgeois as scientist. He understood the methodological importance of induction, the needs of the rising bourgeoisie, and attacked the humanists for their patronage by the nobility. Against them he posited the first technocratic vision of the State — his Nova Atlantis — where scientists became the rulers and the staff of the nine departments of this state. Scientific co-operation had certain aims: the control of nature, the progress of knowledge, fraternity in learning, co-operation in manufacturing skills, and progress through profiting from the control of nature. These goals are still, in general, the goals of modern science, as many editorials in Scientific American, Nature, or The New Scientist attest.

Bacon's ideas and advice were taken seriously and led to the founding of learned societies with these practical goals. Others, like Campanella and even Descartes and that stupid Franciscan monk, Marin Mersenne, had had similar ideas. In the masochism of Mersenne's cell at Mimins, Pascal was to meet Descartes and be stirred to the ideals of fraternity which would eventually lead to the setting up of the French Academy in 1663.

What all of this needed was to turn it into a business, and financing was no shortcoming since merchants needed scientists as much as scientists needed merchants. The little self-appointed bureaucrat, Henry Oldenburg, who founded the Royal Society in 1660 under the conciliatory auspices of Charles II, was to be its unpaid organiser. Radical bourgeois cells ("invisible colleges," Boyle called them) were being set up all over Europe. In 1647, two years before Britain became a (temporary) Republic under Oliver Cromwell, William Petty, who would help finance the setting up of the Royal Society, advocated in the name of Bacon "the establishment of a new college of tradesmen; incipient engineers (surveyors, millwrights, smiths and clock makers); incipient industrial chemists (metal smelters, assayers, distillers and pharmacists); tool makers (opticians, rule makers, gaugers". Oldenburg began publication of the Philosophical Transactions through which he set out to unify all scientists "and those who delight in the advancement of learning and profitable discoveries."

Through the Royal Academy and the French Academy and other institutions, information was organised in a way which would be useful for manufacturers, by setting out to gather and test it systematically. And so the spirit of modern science was born.

And yet despite its revolutionary goals and the fact that it had to displace religion as a hegemonic force in order to survive, it was born deformed, sustained and nourished by a class society. The anarchist Peter Kropotkin (despite all his reformist educational goals so common to its time) points out that the early scientists did not disdain manual work. He decried the fact that "the man of science must discover the laws of nature, the civil engineer must apply them, the worker must execute in steel and wood, in iron or stone, the patterns devised by the engineer …the worker has lost the intellectual interest in his labour, he has lost his inventive powers." And he goes on to point out the inventiveness of early workers: "Smeaton and Wheaton surely were excellent engineers; but in their engines a boy had to open the steam valve at each stroke of the piston; and it was one of these boys who once managed to connect the valve with the remainder of the machine so as to make it open automatically, while he ran away to play with other boys…"

Marie Boas history cites that "useful chemistry was no longer medical but rather industrial and many members of the Royal Society brought in accounts of everything from mining to soap making and dyeing," although she points out that the Royal Society always had the atmosphere of a philanthropic aristocrats' club for "gentlemen and works of fancy." All that this meant, however, was that these goals were to be expressed elsewhere — in industry and in the universities. By the death of Newton the standards of science had been laid and were completely bourgeois.

## The Science of Power and the Power of Science

While so many eclectics today fantasise about past scientific glories, the club of applied scientist and their journalistic apologists keep beating them over the head with spectacular humbug about progress and technological invention. At the beginning of the third millennium, we are already some twenty years into a second scientific revolution; most of the conditions have already been achieved, the internet is well established, the first steps towards genetic engineering have been taken with the deciphering of the genetic code and tasks which took decades can be achieved in years. It is not dissimilar in tone to the 1830s. But we must understand this industrial revolution better before we are swamped by the second. The discovery of the 1$^{st}$ law of thermodynamics and its application by capital was the single most far reaching theoretical event of the early part of the 19$^{th}$ century, one which transformed it utterly, both politically and economically. Count Rumford's discovery that work done in overcoming friction produced heat was to lead Joule, some 40 years later, to carry out the first experiments proving that a certain amount of mechanical energy could always be transformed into the same amount of heat. This theoretical study was used by Watt and James Nasmyth to develop the steam engine, which had such a profound effect on labour and society. Artisans were fired and, in England, a Luddite radical movement thrown up to smash steam machines wherever they appeared.

What the first theorists of thermodynamics were unable to understand in the practice of their class, the Luddites were unable to understand in the theory of their own. If bourgeois ideology thought of scientific theory as being pure and standing alone, without having to address itself to its practical applications, the Luddites seemed to think that they didn't have to fight that theory. The Luddites only developed an emotional response, albeit a poetically radical one, but never developed any theoretical challenge to the changed class society. Today, in the throes of the second industrial revolution, practice must never again be allowed to be divorced from theory, and any theory of the powerless or dispossessed must never be divorced from practice. The reality around us, too often remains hidden from our view, because we are looking at it through the distorting lens of the separation of theory and practice; but when the refractive shutters are removed and reality opens up to us, we wonder why we had never seen what was really very obvious all along.

The twin roles of science as a force of production and social control developed over a long period, with some branches of science becoming fully industrialised in the $19^{th}$ century while other branches, like biology and geology, remained in the stage of classification until now. Even the classification still in use in biology today — genus, family, order, class, phylum and kingdom — reflects $17^{th}$ century social society and its order, while the $21^{st}$ century rushes ahead with DNA codes. Recombinant DNA for profit or genetic engineering is finding new uses in production, while the growing influence of psycho-biology promises greater social control; these are aspects of biology developing into a science with industrial and medical applications.

Science in all fields in the $17^{th}$ and $18^{th}$ century still retained a spirit of philosophical adventure which sought to learn, interpret, and control nature and hadn't yet become entirely a business. Its methodology was still philosophical, posing questions as to the nature of phenomena. Before Franklin's experiments, electricity was seen as a fluid that could be bottled in Leyden jars; astrology was a fundamental part of astronomy before Tycho Brahe and Kepler shifted methodological emphasis towards the telescope and mathematics; "calorific" and light were still considered as elements in Lavoisier's "Methods of Chemical Nomenclature" before the energy conservation laws were developed, although Lavoisier did help banish the ghost of phlogiston. But calorific, phlogiston, mother nature, God, supply and demand, ether are all examples of philosophical concepts which, although serving a purpose in their time, would have to be overthrown before science would be able to proceed systematically. Seventeenth and $18^{th}$ century philosophy was to begin as an ally of science in smashing the harmonious cosmos of religious power before it was to collapse under the weight of interpretation, unable to change anything. Through its application, however, Science was transforming the world, pushing its influence into business and commerce all over Europe.

At that time, as today, technological applications did depend on the state of science, but the state of science depended far more on the requirements of technology. Despite what scientists themselves may say, pure research has never been very pure, and it depends mostly on those things which business needs that get done to make a profit. There are still those who look to modern science and try to make a distinction between the theory and the application, the search for data and the misuse of it. They try to distinguish between "pure" science and "applied" science, as though such distinctions meant a lot anymore, but most of these pseudo-romantics are merely describing a state of affairs they would like to see rather than what exists.

A study in the 1960s in the U.S. found an average 30-year lag between basic science research and technological application, by 2000 the boundaries between science and technology are almost totally dissolved. As a joint report of the American Academy of Sciences states, "Basic research is conducted predominantly in the universities; much applied research and development are carried out by industry. Overall, while industry does about 70 percent of the nation's research and development, only 4 percent of that effort goes to basic research. The same report, which was something of an American 5-year plan goes on; "Scientific and technological change intertwine ever more closely. Opportunities are coming so fast, and competition for markets for advanced technologies is becoming so intense, that success will depend directly on the ability to create and then to exploit the new knowledge quickly…The implication is that, more than ever, basic science will be vital to technological advance and in turn, to better productivity and enhanced economic growth."

In 1790, when Leblanc won the French Academy prize for a new method to produce soda lime, his method remained an industrial secret even although he had used Lavoisier's nomenclature (sodium hydroxide, sodium carbonate, sodium chloride). But 8 years later, the French Revolution in an act of bold rashness common to all revolutionary experiments, forced Leblanc to reveal his soda lime making process for the "common good" and seized his factory without any indemnity. Lavoisier, the declared father of modern chemistry but also an aristocratic tax collector, was less fortunate: he was to lose his head. His defence, that his taxes paid for his chemical research, should be a lesson to professors with cushy jobs and fat grants from the military-industrial complex; a fatal miscalculation.

In the 18$^{th}$ century chemistry had its share of aristocratic philosophers and even philantropers, although the producers dominated. Cavendish, born on the French Riviera to a rich widowed mother who died there soon after his birth, is in many ways an exception to the rule. He turned out shy and timid, writing little notes to his servants, never wishing to meet them. He even had his library moved 3 miles away from his laboratory so that he wouldn't meet anyone who came to borrow books. He never spoke to a woman in his life and was scared to look at them. Working silently away among the glass jars, he discovered hydrogen gas, though he was loath to tell anyone about it. A brilliant, lonely, and extremely rich madman making philosophy with weights and balances, he is remembered most for his experiment on the gravitation constant whereby he measured Newton's mathematical formulation and was able to weigh the earth.

But the tradition of the scientist carrying out research which would be used directly in production held sway well into the 19$^{th}$ century. It would change only with the emergence of the scientist as manager or technocrat in the 20$^{th}$ century. Bessemer is typical of the scientist-producer. In the midst of the Crimean War he opportunistically set about devising a way to make a form of iron which would be strong enough for large cannon, and discovered a new process for making steel in the blast furnace, an idea he tried, unsuccessfully, to market to the British and French monarchies. In 1860 he set up his own plant, introducing an era of cheap steel which opened the way for the big steel capitalists like Carnegie, Schneider, Krupp, and Vickers. Solvay, who invented a chemical process any schoolchild knows about today, made a fortune from his chemical inventions and spent most of the rest of his life endowing schools that others might receive the education he had never received. His system of economics was to include management by scientists — a formulation later to become known as technocracy.

The $20^{th}$ century saw the emergence of the scientist-manager. With the development of Big Science, in which laboratory equipment meant a tremendous investment by industry or by the state, science was to become merged into an ideology of management. This became more critical with the development of particle accelerators in the 1940s and the large computers of the 1950s. Rutherford at the Cavendish Laboratory at Cambridge with his upper class school master ring to him, was exactly the old-boy type of manager that existed in British society at that time.

Faraday is generally credited with the discovery of electromagnetic induction in 1831. Following Oersted's lead, this member of a fanatic Protestant sect which eschewed all worldly vanity, refused to be knighted or even to be made head of the Royal Society and refused to help make poisonous gas during the Crimean War (although he did accept an invitation to have dinner with Queen Victoria). He was actually convinced that the facts of electricity and magnetism, as then known, led to atheism and materialism; he was almost forced into field theory just to give a place to his god. But the unification of electricity and magnetism really led to no new applications until the end of the century, and Faraday's importance for well over 20 years was more as an authority on science than as an applied scientist. He was the person always called upon to give expert opinions in Victorian society — much as scientific experts are invited to TV "talk shows" today. Faraday is an early example of the later political role of scientist-managers of the $20^{th}$ century; — the need to appeal to a scientific authority. The actual word "scientist" was first used only in the $19^{th}$ century, when William Whitwell (1794–1866), a Cambridge scholar, began to use it.

As the British "Council for Science and Society Report" (1976) states: "the opinions of experts must be capable of effective and independent expression…a deliberate effort must be made to maintain a corps of experts who are not committed to the project. The monitoring process no longer lies in the realm of hypothesis and intellectual debate: it has moved into the political arena. It therefore partly takes the form of a trial of strength between power groups. The experts are caught up in an adversary process." Scientific method, like it or not, had become a political debate among managers.

Einstein's mass-energy equation and Rutherford's chance discovery of the scattering effect of alpha particles are two of the most important theoretical events in the early part of this century, rivalled perhaps, only by Freud's mapping of the unconscious. When Otto Frisch wrote his memorandum in 1940 that a superbomb with the explosive power of thousands of tons of TNT could be prepared from suitably prepared uranium, it was to lead by mid-1942 to the development of the Manhattan Project, in which scientists like J. Robert Oppenheimer, Enrico Fermi, Arthur Compton, and Ernest Lawrence participated. The effect of the 2 bombs eventually dropped on Japan was not only the 120,000 dead and the same number injured; it meant that the original scientific goal of the control of nature had been met in a way that those who controlled nature now had to be given social control. It was not the killing effect of the new bombs that made their use necessary; low-level air attacks on Japanese cities achieved casualty rates much higher than that at Hiroshima or Nagasaki. The Compton excuse, "how to bring the war to an early end," is merely a technocratic justification: Germany had already been defeated and Japan was on its knees.

What they are really excusing is the dominance of an ideology of technological determinism, the idea that it is impossible to change anything except through technology, thus making it impossible for ordinary people to assert their wishes and their future over the cult of science.

R.R. Wilson, who had worked with Lawrence at Berkeley, bemoaned the passing of the old days of science, when "all you needed was a box and a bunch of wires." Wilson fought a losing battle against corporate team research, making the interesting though quirky comment: "Being the director of 20 or more physicists involved much more than physics, it involved raising money, getting people, finding places for them to stay, spending $1 million". The point is valid, however.. Today's scientists are more narrowly trained and more intensely focused on the details of their research than on the larger canvas of society. Equipment is expensive and Labs employ hundreds of people and the competition is furious. Directors of large labs no longer even lay hands on pipettes or petri dishes and lab-chiefs spend their time writing grant proposals and travelling from meeting to meeting explaining what is being done to the rest of the elite science corps. They work with press officers and public relations firms who pursue journalists and the media bytes without ever considering any overall philosophical implications. Unlike the old scientists who had often to design and even handcraft the tools with which they worked, they themselves, with some notable recent exceptions, have become pure tools of a business strategy.

While Oppenheimer opposed research on the H bomb, and Lawrence supported it, the difference between them is merely the differences between the two managers. It is said that Oppenheimer ran Los Alamos using the "committee" as a weapon, whereas Lawrence was absolute boss. Oppenheimer at least knew something of the impending decadence of science; his comment after the development of the atom bomb that "science has learned sin" shows that he realised the absolute power of science and the decadence of that power, although he was interested only in reforming it. Victor Weisskopf, who worked for Oppenheimer before he went on to run CERN and later became scientific advisor to the Pope, agreed with Oppenheimer that what the world needed was more science to distinguish between destabilising progress and stabilising progress.

Behaviourism was the raison d"tre and scientific ideology of the post war period, based on the ideas of John Watson and the work publicised by B. F. Skinner, and posited the view that all human behaviour could be explained in terms of conditioned reactions or reflexes and the habits formed in consequence. But this was really the outcome of the reality of the Fordian production line, with everyone to their own little task, a long stream of lights, task following task, an ideology which had disastrous effects in the design of modern urbanism, the city reflecting the production line. Noam Chomsky's attack on Skinner (1959) gave the first fatal shock to the feeling than all was scientifically well in post Rock & Roll America. If language was merely learnt behaviour, then humans could be rewarded or punished like the rats and monkeys in the lab, a vision Chomsky duped as "a well-run concentration camp". Behaviourism denied human nature -and the same is true for much of the Marxist left (though not Marx himself), that people are inextricably constructed by their historical conditions and environment, the essence of managerial politics (creatures are malleable and ignorant and can be modified by experience and training and thus can, under the right conditions, be controlled) thus removing the moral barriers to manipulation and coercion. In the name of science (albeit social science) behaviourism went further down the road of the scientific explanation of obedience to authority than religion, precisely because it deemed itself scientific. But as Roaul Vaneigem in his seminal book "The Revolution of Everyday Life" (1967) has pointed out "The shock of freedom works miracles. Nothing can withstand it -nor mental distortions, not remorse, not quilt, not the sense of importance, not the brutalisation produced by the world of Power. When a water-pipe broke in Pavlov's laboratory, none of his dogs who survived the flood showed the slightest trace of their long conditioning".

Whereas art under the conditions of the modern spectacle has become the terrain of pseudo-creativity, science has become the terrain of pseudo-progressiveness. The general idea goes something like this: "Isn't technology marvellous, just look at what it has given us," and we are given a list of inventions: the transistor (1940), terylene (1941), the nuclear reactor (1942), the atom bomb (1945), the computer (1946), automated manufacturing at Ford (1946), the H bomb (1952), videotape (1952), plastics (1953), Sputnik (1956), lasers (1960), the neutron bomb (1963), optic fibres (1972), the test-tube baby (1978), the artificial heart (1984), the Internet (1985), the "cloned lamb" (1996) or some other such list. The implication is that all problems can be solved; scientists are presently working on it, and we shouldn't really be worrying our little heads because they are sure to come up with something. Gone are the bad old days when suffering and starvation were necessary. Today scientists are working to eradicate these leftovers from a primitive past. Gone are the days when it was necessary to revolt. Just wait. Let us walk all over your face, take your money. It is for the good of mankind, peace, and progress.

Only more and more people wake up with a choking feeling and not only begin to wonder, but begin to question scientific certainties.

# Chapter 2: The Informed Informer

## Computers and Technology

### i

The computer is probably the defining symbol of the twentieth century, just after the war machine. From the abacus to the invention of Boolean logic the impetus for the design of these machines had nearly always been geared to easing the task of counting money. When the Belgian tradesman Simon Stevin (1548–1620) wrote his "Table of Interest Rates" it marked a new era in banking because prior to this, such tables were guarded as valuable capital equipment. His application of the decimal system to commerce ("The Tenth," 1585) was a breakthrough for accountancy which would eventually lead Jefferson in the U.S. to adopt it as a monetary system long before England. The invention of logarithms by Paul Napier, a Scotsman, made calculations all the easier but the attempt to design a machine which could carry out all these tasks was a prize goal of bankers and merchants alike

La Pascaline, one of the first mechanical calculators, was designed by the Jansenist Pascal to help his father work out the property taxes he was going to charge his poor peasants. From Babbage's Analytical Engine of the 1840s to Hollerith's Tabulating Machine in 1890 there is a fascination with making the task of calculating taxes and profits easier by the employment of number-crunching machines. Hollerith's punch cards (he says he got the idea from a ticket inspector who punched his destination on his ticket) had already been used, in 1805, by the manufacturer Joseph Jacquard, who used a moving belt of punched cards for weaving rugs, an idea that Babbage had intended to use for his Analytical Engine. Hollerith was later to assist the tycoon Watson set up the company (later to become IBM) which sold and rented thousands of these tabulating machines to small companies for the express purpose of counting money.

Such precursors to the computer were plagued by engineering problems. Babage's machine was impossible to build because of the refined engineering skills required (he spent most of his large fortune and a larger fortune of the British government in the effort) and never really got beyond the planning stages. Ada Lovelace (Byron's daughter) used Babbage's notes to publish her own account of the Analytical Machine (she is sometimes known as the first programmer and the U.S. military has recently used her name for their own computer language).

The original giant computers, such as the Eniac, Mark 1, or the Edsac were cumbersome, bulky machines, at least one of the 18,000 vacuum tubes of the 1946 Eniac, developed at the University of Pennsylvania, would burn out in an average of 10 minutes. They could carry out this one task and no others and were scrapped when no longer needed. Von Neumann's idea of building an internal program into the computer (the 1951 Univac), thus allowing multiple usage and with the engineering development of the transistor in 1947 and the invention of core ferrite memories by An Wang, the first random access memory (RAM) device, all that was left was the development of re-usable code. The early computer languages, FORTRAN, COBOL or BASIC developed the use of formulae and a kind of baby language to perform routine and pre-defined tasks. From the first uses of recording devices, (through cave paintings and the invention of tablets) up to the invention of paper there elapsed approximately 40,000 years (by current estimates). From the use of paper to the use of the printing machine (from say 105 AD to 1440) there elapsed 1300 years. It was to take another 500 years to develop magnetic storage. It has taken 50 years to develop laser storage.

In 1946, America's ENIAC machine could perform 5000 additions and subtractions in seconds, by the 1980s computers would perform 10 trillions calculations per second -what would take 10 million years on a hand-held calculator. The introduction of batch programming and compatible operating systems (the IBM 360 operating system was the first) allowed the standardisation of compilers and allowed software to be run on various machines and by 1981 IBM had introduced the PC, the first consumer model, based on an Intel microprocessor and running the DOS operating system, licensed by Microsoft. The early development of computers was totally proprietary with one vendor's product only working on that system and no other system and it remained in the realms of mathematical and logical languages which restricted their usage. With the development of graphical user interfaces (Apple and Microsoft Windows) the computer moved away from the strict world of numbers and bytes and mathematics to the sharing of information, a development which would lead to the Internet.

In 1971, a half-million pages of technical reports, scientific journals, and books were being produced in the world every minute and the figure may have risen ten-fold since then. Also a system was needed for sifting through the millions of patents (the bourgeois seal of ownership) and through chemical, medical, and legal information. It was the needs of capitalism, not the desire to put people in touch with each other which developed the Internet. When Eisenhower was advised in 1958, given the intensity of the Cold War, to set up the Advanced Research Projects Agency (APRA) for the military, in an attempt to keep the US in the forefront of technology, it is doubtful that anyone could predict its outcome. In an effort to link up the various military projects and the research computers it funded, a new communications protocol from computer to computer (Network Control Protocol), was unveiled at Los Angeles University in 1969. Electronic mail was added by 1972 and soon the protocol was changed to TCP/IP and accepted as standard by the US government by 1978. Commercial ventures wanted access to it as did other universities and a system whereby messages could be packaged and sent independently over the internet as if they were electronic letters passing through an electronic post-office was developed with addresses (numbers) for particular computers being developed.

The World Wide Web (WWW) project, proposed by the European Laboratory of Particle Physics in Geneva, in 1989, and the development of a language for linked computers known as HTML (Hyper-text Markup Language) allowed the links between computers to become easier. The development of "gophors" and then "browsers" facilitated the searching, sifting and uploading of data from connected computers, so that today people can sift through millions of articles, books or journals and "the global village", as Marshall McLuhan called it was born.

*

The project of self-realisation, communication and participation is the essence of healthy daily living and it is hard to see how the isolation of our TV screens (no matter how many channels there are or however interactive they are) will make this possible. TV leads through a kaleidoscope of passive experiences, without being present in any of them, to the blunting of the powers of participation and a life of passivity. It is not a matter of the quantity of channels; one hundred times zero still amounts to zero and a mountain of advertised beans. Nor, with the computer, is any amount of hiding behind our computers monitors going to reduce our isolation. "Being alone together" is the essence of the Internet, we are all "on-line" but not in line, spectators not actors, passive consumers not creative imaginative people. The alternative to intimacy is to isolate ourselves ever more from each other, hiding behind handles and shifting personas, remote forms of communication and anonymous conversation which we may think of as freedom but which really increases isolation and creates a society of automotons.

The very language of packet-switching which formed the basis of the internet takes the technology away from people-orientated machines into the very essence of the consumer product. When a phone line connects two parties, it is dedicated to their conversation, silence and all, with silence occupying at least one-third of talking (under normal discourse). On the internet, talking becomes a transmission of data-stream and packet-switching allowing for all silence to be abolished. But silence is at the heart of rebellion. Witness the lover's tiff, where the silence of one partner can be more damning than the aggression of the other. What real communication is there without the silence? It is the technological android communication of modern existence which stresses isolation as its essence. Humans are reduced to staring at small windows, through which they communicate when they want, not when they need to. Isolation is reinforced. As Vaneigem wrote "They stayed in the cage, estranged from everything except the cage, without even a flicker of desire for anything outside the bars. It would have been abnormal-impossible even-to escape into something which had neither reality nor importance… We have never emerged from the time of the slavers."[1]

On the other hand, it is said that the Internet increases the possibility of unmediated communication and that the Internet is not owned or controlled by any company, corporation or nation. It connects people in hundreds of countries instantaneously through computers, fibre-optics, satellites and phone lines, helping people to keep up with world events, find cheap flights, send e-mail to their friends world-wide and look up anything from Alcoholic's Anonymous to Zymology and as a means of evading bourgeois media limitations. All of this is certainly true, the computer is a tool, just as a machete is a tool. Just a machete can be used as a weapon so too the computer, witness the Zapatista's use of the Internet in the 1990s and it is true that the protests in Seattle, in 1999, were heavily reliant on net organisation.

The trashing machine, which spawned the ire of the Luddites, was also a tool. But tools are not neutral items, they are used by the class in power for particular ends and it is this struggle about the use of technology which is the crux of the matter. Technology is never neutral, it comes clothed in ideology and it is the ideology of the dominant powers in society which determines its subsequent usage. For the computer it is the struggle between its use as a "information" superhighway and a channel for e-commerce. What was once open, although limited, since few people had access, has become a mass phenomenon with any potential freedoms under severe attack. In an interesting book, Stephen Talbott has written "It is not a happy task in the face such optimism(about the internet), to have to argue that computers and the Net have become the most highly perfected means yet for scattering of the self beyond recall. This is already hinted at by the common experiences of Net converts who find themselves enthralled by Walmart-like aisles of cyberspace, stocked with a glorious surfeit of information"[2]

Yet this "surfeit of information" is the exactly disease of the spectacle where everything remains atomised and is never made coherent. The information is there, but in a myriad of facades so that the central body is never seen, the dizzying succession of images and sound bytes and muzak bombard the spirit until a famine in some remote country becomes as important as the exuberance of a lottery winner. It is the this freedom of action in using the technology which actually enslaves. One is never fully present in the spectacle, but only surfing from one place to another, racing through endless kilobytes, keeping up with recent data, but never getting to understand in any profound way, the totality of what surrounds us.

Centralisation has raised the threat of totalitarianism and wire-taps and random scrutiny of e-mails raise, from time to time, the threat of Big Brother. But it is in the structure of power and its power over technology that this threat exists. It is only a small part of it. The hacker is antidote to this power and decryption techniques can be developed by credit card companies as much as anti-capitalist net organisers. What is more important here is the distance created between the user and the world and other users, the apparent immediacy of the depths of cyberspace where there is no human interaction, rather like those smart telephone answering machines which display a list of choices, endless and often meaningless choices until patience is lost and you are forced to "hang up". It is this development of the computer, through the manipulation of graphical user interfaces etc, with its apparent range of choices which diffuses responsibility and participation that is the more insidious. The construction of cyber-communities, whether in sex-clubs or pagan rituals or even strawberry-growers is exactly that, a myriad host of parallel communities, which apparently reduce our isolation but which in fact increase it, having no real basis in society. It is a society of automatons without flesh.

### ii

All new technology impacted on the life of its users, whether the steam engine or the car, but never more so than in the development of electronics. The twentieth century saw technology advance into everyday life, transforming household appliances and impacting on how people lived and divided their day. In devices ranging from the vacuum cleaner to electric stoves and heaters, electric kettles, coffee-makers, refrigerators, freezers, blenders, waffle-makers, food processors, automatic washers and dryers, machines to shampoo carpets, wax and polish floors, not to mention radio-cassette players, CD players and of course, the television and home computer. It was the development of electronics which modernised capitalism and brought so many commodities into our lives, from the invention of the vacuum-tube and the diode (1904), the transistor (1947) and the Integrated Circuit (1958) and finally the silicon chip (1961). As Raoul Vaneigem put it as early as 1967 "The dictatorship of commsummer goods has finally destroyed the barriers of blood, lineage and race;with its logic of things, forbids all qualitative differences and recognises only differences of quantity between values and between people. The distance has not changed between those who possess a lot and those who possess a small but ever increasing amount; but the intermediate stages have multiplied, and have, so to speak, brought the two extremes, rulers and ruled, closer to the same level of mediocrity. To be rich nowadays ,erely means to possess a large number of poor objects"

2

But the real logic of the use of the computer is in advancing its usage as tools for the extraction of maximum surplus value-what is called robotics. While Homer described maidens of gold, mechanical helpers built by Hephaistos, the Greek God of metalsmiths and the golems of medieval Jewish legend were robot-like servants made of clay, brought to life by a spoken, industrial robots were only possible in the mid-1950s. There were only 200 industrial robots in operation in the

US in 1970. By 1983, there were 6,000. And by 1999 there were 100,000. Today there are three quarters of a million of such robots at work in factories all around the world, more than half of them in Japan..

The auto industry, the electronics industry, shipping, mechanical engineering, manufacturers of metal goods, etc, have all intensified their use of robots. Where production has not been suited to robotics, other uses, like material handling devices and computer controlled tools, are being found. Robots don't go on strike, get sick (though they need to be maintained) and do not answer back. Thus one of the drawbacks of traditional labour has been overcome, the human side and replaced by an ever-even android, measured in MIPS (millions of instructions per minute). The operating costs of robots vary, but current estimates put the cost of the most sophisticated kind now available (a so-called six-axis, servo-controlled, computer-driven robot) at a quarter of the price of a conventional worker. Factories can be redesigned with robotics in mind and this eventually saves on the cost of fixed capital because concentration of the means of production cuts costs in all manner of buildings, not only workshops but storage space (through information on storage, deliveries and orders, transportation of commodities etc.) More than any other development it really does represent the dominance of dead labour over living labour, of constant capital over variable capital.

3

Under capitalism, robotics can never abolish labour: it merely changes the position of the workers in the work-force. The abolition of wage-labour will mean the abolition of capitalism and of those who use profits (the result of current or former exploitation). Yet robotics can reduce boring or dangerous jobs and reduce menial labour, they can drive trains, defuse bombs and investigate volcanoes and do things than humans can't -or shouldn't do. If robotics has reduced the labour that is included in products that are made then one might ask where this reduction of labour has gone. True, it has created massified and cheaper commodities but has not reduced the working week or the quality of life, so therefore it must have gone into capital.

The intelligent android has become the role model for all of modern existence. It carries out its tasks without question of obedience or loyalty. It is said that a robot can never have the sensory or decision making abilities of a worker, that it is capable of detecting only those things that it is programmed to detect, but in some ways that is the state of all of modern everyday-living. We are all "running on automatic" in our everyday trance and react to so many stimuli of "hypertextual icons" that this has reduced us to unfreedom and statistical predictability, and loss of ourselves in a world without dimension. One offspring of technology has been the development of so-called Virtual Reality, a kind of false life-like three dimensional world where the player can determine the outcome of that reality. In many respects this has already become the political and social reality of modern capitalism.

But it is only when we awaken from this automated sleep that we will ever begin to test the world around us.

# Chapter 3

## 1. Research Clones…

The idea that genes determine social behaviour is not new. Zola's Rougon-Marcquart novels, often praised for their "socialist realism," chronicle the two halves of the same family, descendants of one mother but two fathers. The descendants of Rougon, the peasant, are ambitious and hardworking while the descendants of Marcquart, the drunkard, are degenerate and alcoholic. Dickens's Oliver Twist was raised in the parish workhouse and educated into a life of crime by Fagin but nonetheless developed honesty and gentleness and spoke perfectly grammatical upper-class English. This quick turn of events is explained by the fact that he is really the child of an English nobleman. On the other hand, George Eliot's Daniel Deronda is raised by an English nobleman but finds himself with a passion for all things Jewish which is all explained in the end by the fact that he is really the son of a Jewish actress. The realm of science fiction -whether in Mary Shelley's "Frankenstein" or in H.G.Well's "The Island of Doctor Moreau" has shown how messing about with genes can create monsters.

The argument that genetics determines intelligence is very often "backed up" by IQ studies which believe they are testing intelligence and not some other factor — such as social or class background — which might explain different scores. H. H. Goddard, one of the main architects of the hereditarian interpretation of IQ tests, carried out IQ tests for immigrants upon their arrival at Ellis Island, declaring 80 per cent of them morons, the southern Europeans below the Irish, below the rest, none of them, of course, coming within hailing distance of the descendants of the Mayflower. From IQ tests a heritability estimate is taken which pretends to measure the proportion of variation observed in a given trait. Since black and white IQ scores differ so much, idiotic professors like Arthur Jensen argue that education for blacks is really a postponement if not a waste of time. Other researchers have tried to establish this connection by the study of identical twins reared separately. Sir Cyril Burt was a noted example. For years he was the researcher who had assembled the largest amount of data on this subject, and his study was apparently rigorous in its analysis of the figures. It was the study used by racists such as Jensen and others. Burt became somewhat notorious when a London "Times" report showed not only that the two co-authors cited in the study were figments of his imagination but also that he suppressed chance variance to make the data correspond to preconceived ratios. This was a case of cooking the figures deliberately to produce a biased result. But how many times does this happen unconsciously?

Stephan Jay Gould has repeatedly demonstrated the role that cultural bias has played in science. His essays have poked fun at such things as the conservative preference for gradual change, the correlation between brain size and intelligence, IQ testing, and the conscious and unconscious racism and sexism of many scientists. As one example, he cites the 1909 Piltdown forgery, in which three men, the geologist Smith Woodward, the lawyer Charles Dawson and the future mystic scientist, the Jesuit Teilhard de Chardin, "discovered" a skull in the British countryside with an apish jaw and human cranium. In 1953, however, tests showed that it was a fraud. In trying to explain why such a fraud was so readily accepted by British palaeontologists, Gould finds that his answers do not conform to "the usual mythology about scientific practice -that facts are 'hard' and primary and that scientific understanding increases by patient collection and sifting of these objective bits of pure information. Instead, they display science as a human activity, motivated by hope, cultural prejudice, and the pursuit of glory, yet stumbling in its erratic path toward a better understanding of nature" (The Panda's Thumb, 1980).

Piltdown was accepted because science, while claiming objectivity, is in fact often subjective and arbitrary. Piltdown helped buttress certain racial views with the appearance of hereditary trees based on Piltdown Man and affirming white supremacy. It also made God an Englishman — as had had long been suspected. And it certainly proves the pious opportunism of the Jesuit theologian.

As a science, genetics is the child of 19$^{th}$ century determinism. With the rediscovery of Mendel's work (in 1900) renewed efforts were made to validate the idea that character and mental ability were genetically determined. In the 1960s ethnologists extended this to a wider variety of social behaviour and by the late 1970s sociobiologists had extended the conclusions of ethnology to the human condition itself. The author of "Socio-biology: The New Synthesis," E. O. Wilson, a Harvard professor of biology, uses genetics to defend the status quo. The book contains 25 chapters on insect behaviour; a final chapter, "From Socio-biology to Sociology", tries to draw analogies with human behaviour, suggesting a genetic basis for such phenomena as competitiveness, sex roles, cheating, and the free market economy. The prime cause of male aggression is caused by the presence of the hormone testosterone, female "passivity" by the hormone oestrogen. The torture of capitalism is no longer important — it's now all in your genes, so to speak. Faults and imbalances in society are rooted in the faults and imbalances in genes; the "cultural" transmission of learning is turned into its opposite, a genetic code for culture. The passage from non-human to human behaviour is made by exaggerating small genetic changes over billions of years and ends up in the area of religion and speculative philosophy through the jump into ahistoricism. Like Hitler, who described his own methodology as "the final step in overcoming historicism and in the recognition of purely biological values," socio-biology will take its place in the scientific hall of horrors, along with eugenics and cybernetics.

The dictatorship of dead labour over living labour has now reached pyrrhic proportion. Alongside the increased cost of fixed capital due to the need to invest in machinery and plant is the higher cost of certain commodities — oil is a central one — used to produce other commodities. Keeping wages to a minimum, capitalism seeks new ways to reduce constant capital. The period after the Second World War has seen a proliferation of new materials flowing from the greater understanding of organic chemistry and especially and more recently, of various branches of biology.

Chemists were able to rearrange the loops and chains of carbon, oxygen, hydrogen, and nitrogen in organic materials not only to create lighter and cheaper plastics but to induce properties such as conductivity and tensile strength. Some more recent commodities include plastic car engines, packaging materials, paper-thin solar batteries that can be peeled off a roll, and a host of other products. Plastics production surpassed that of steel in 1975 and has been increasing ever since, using only one tenth the amount of energy needed for steel production and half that required to make aluminium.

The field of biotechnology and especially what is popularly known as "cloning" has opened up a whole new method to reduce the costs of raw materials. Of all the sciences, biology and geology were the slowest to progress. But with the greater understanding of atomic structure and the discovery of the genetic building blocks of DNA in the 1950s, biochemistry was able to surge ahead. Until the 1970s, molecular experimentation in biology was, with few exceptions, limited to bacteria. But with the development of recombinant DNA methods, or molecular cloning, the study of plant and animal genomes (data contained within the DNA) was made possible. Relatively short segments of DMA were isolated from the genome and inserted in bacteria or yeast to produce a sufficient quantity of chemically pure proteins.

The result has been that capitalism, having colonised the life of the worker for so long, has moved to colonising life itself, turning living organisms into factories for the production of such commodities as drugs and fertilisers for profit. It is non-labour intensive and almost entirely dependent on investment in plant, machinery and research.

The birth of Dolly, a cloned lamb, in July 1996, created from the genetic material of the udder-cell of a six-year old sheep opened up a public debate on the feasibility and desirability of cloning life itself. Ian Wilmut was able to fuse the egg from another sheep, after removing all the genetic material from the egg making the genetic material from the udder cell take over the growth and development of the egg. and although Wilmot himself abhorred the idea of cloning humans or human parts, he saw no theoretical reason as why it could not be done. Wilmot's sponser was the Scottish company, Pharmaceutical Proteins Ltd (PPL), which wanted to set up drug factories using animals, primarily to produce and sell clotting factors for haemophiliacs. Other immediate economic uses are possible. Like cloning prize-winning dairy cows which can produce 40,000 pounds of milk per year as against the average 15,000. Such cows are difficult to breed in the traditional selection-based way. As an article in The Economist wrote as early as 1981, "To turn the base metal of biology into big profits will need not only a lot more basic research but also a lot more practical experience and larger investment. Risks will be high, patents hard to enforce, competition frenetic and most products, when they come, will be rapidly obsolescent." Since then, bio-tech research in the U.S. and Japan has been applied to food processing, mineral extraction, the making of fertilisers, waste utilisation, pollution control, drug manufacturing and, more recently, food production.

The idea that a single cell could regenerate whole plants dates from Theodore Schwann in 1859 (he later became a mystic) and August Weismann, the professor of Zoology, quoted by Darwin on the first page of his "Origins of the Species" who asked why cell structure had such an important role to play in the development of the individual and even the species. Embryologists such as Hans Spemann who spliced a salamander embryo to produce two living salamanders (winning a Nobel Prize for Embryology in 1902, something not to be repeated until 1986) and Robert Briggs and Marie Antoinette Di Berardino (1951) who transplanted a frog nucleus into a frog egg. When Watson & Crick published their work on the structure on DNA the field was open. The first test-tube baby, fertilised in a petri-dish and replaced back into the womb was done in 1978 and led to the idea that parents could choose the sex of their children, the Y chromosome (boys) or the X chromosome (girls). Mary Shelley had come of age.

As recombinant DNA methods have become big business, governments have passed laws allowing companies to patent life itself. Plant patenting was first instituted in France in the early 1960s for certain types of roses, and this disease has spread to other varieties since then. Patenting implies genetic uniformity, as governments decide to allow only patented seeds — those listed in the EEC "Common Catalogue" — to be grown. Diversity in agriculture is thus upset and defence mechanisms developed over thousands of years are undermined, thus creating an ever-greater dependence on pesticides.

Having colonised the work life through the extraction of surplus value in the nineteenth century, capitalism was then able to colonise leisure by turning everything into commodities in the twentieth century and now in the twenty-first century attempts to turn the entire genetic code into capital with companies patenting ever more various strands of DNA. Bio-tech companies regard living genetic material as "inventions" or products. "Genetic codes have been developed commercially for such things as yeast, viruses, bacteria, a fruit fly, a nemotode worm, a human being and a small weed related to the mustard plant." according to the science editor of The Guardian newspaper.

Genetically modified foodstuffs are everywhere There are already hundreds of patents on rice, for example, (according to Action Aid, the hunger charity) and such companies as Genetech, Monsanto, Syngenta, or Myriad Genetics have already started to patent life itself. Syngenta (based in Switzerland) has recently entered into a deal with Myriad Genetics (based in Salt Lake City) to race through the genome of rice, the crop which feeds half the planet. Myriad Technologies is already infamous for having already taken out patents on two genes (called BRCA 1 and 2) linked with breast cancer and Monsanto, who in the past, blocked any discussion of its milk-boosting harmone (BST) even though it was shown to increase the risk of mastitis, have pushed through its genetically modified Soya-bean programme by promoting an advertising campaign aimed at insuring food labelling and claiming that they have put the taste back into strawberries, without ever asking why the taste had disappeared in the first place. Such companies have even started to promote their strategies through liberal-sounding propaganda like wanting to help eradicate world hunger, though common-sense shows that such food will be produced for commodity markets and not the hungry. Bio-tech patents only ensure that control of food production is concentrated into fewer hands. Syngenta claims that it will sell its data on the rice genome to seed businesses and other commercial groups and make its information available "through research contracts", though at a cost.

What is really alarming here is that a crop which has been grown for over five thousand years and provides 80% of Australasia's food calories is now in the hands of a monopoly which are not presently required to grant licences to third parties. The patents, usually granted by the World Trade Organisation (WTO), with the connivance of the G7 countries finances Ministers, are very broad even allowing the holder to have control over products which are not even invented yet and obviously, where companies have a monopoly over production they will automatically extract the highest prices. The companies themselves emotively argue "no patent, no cure" but most sane people can see this is rubbish, even if politicians choose to play their game.

Genetically modified foods may be economically profitable for the agribusinesses which grow them but they provide little benefit to the consumer and the risks posed to long-term human health and the environment are highly suspect . Frankenstein foods may even help spread new animal and plant diseases, new sources of cancer or novel epidemics. There are hundreds of sites which are already devoted to GM crops of potatoes, maize and oilseed rape, so that we have no idea of what we are eating. This merely adds to the already existing problems such as pesticide, antibiotic overload and poisonous residues.

Spectacular science fiction gets so carried away in its claims of what science can do that it actually spreads ignorance by shifting it to the pseudo-rationality of the spectacle. The world is upside-down. Most scientists and science writers speak in riddles. The better distribution of food world-wide turns out to mean fast junk food in advanced countries (not to mention BSE burgers) and development is a way to find the minimum wage required to work cheaply in poorer countries; better transit systems bring people to work and not to where they want to go; more machinery means cheaper wage costs and not the abolition of wage labour; progress is progress towards war, global pollution and annihilation, increased mental stress, and the total denial of creativity for all.

## 2. At War With Science

Wars have always been fruitful periods for scientific research as the needs of defence and aggression cause large amounts of resources to spent in the development of technology. In times of relative peace, research is geared to increased production whereas in times of war, which today is almost all the time, research is geared towards the destruction of some declared enemy.

The Cold War produced the greatest research into destruction ever carried out in the name of rationality. The principle area of the Cold War was the global, nuclear confrontation between two versions of capitalist development, the laissez-faire regime of U.S. democracy and the totalitarian Stalinist model of a centrally planned economy. The collapse of communism, symbolised by the opening of the Berlin Wall in November 1989 brought an end to some 45 years of this bipolar conflict.

Science and technology were at the heart of this Cold War conflict and in both countries the stimulation of scientific and technological development and the application of scientific and technical gains to military problems became the focus of national policy-making and social resources, even effecting the way that science developed. The maintenance of a large military and armaments industry, generally secretive, meant that a large portion of science research effectively went underground. The military-industrial complex became a hidden influence on state policy and the nature of research. In the US, Eisenhower warned that "the American University could become dominated by Federal employment, project allocations, and the power of money while public policy could become captive of a scientific-technical elite". In the Soviet Union, on the other hand, nuclear physics proved of such critical importance to the pursuit of the Cold War that it flourished free of the ideological conformity that surrounded other areas of science like Lysenko (see Ch 5).

Oppenheoimer is quoted as saying, after the bombing of Nagasaki "Physicists have come to know sin and this is a knowledge which they cannot lose". The science practised by this military-elite in developing weapons systems and other tools employed by the Cold War has been called "Black Science", an entirely new form of science which developed its own career system, its own publications programme and its own norms. But to call it Black Science implies a "White or Normal Science" somewhere, whereas in fact this is the very development of science itself.

Tremendous resources were squandered in nuclear submarines and inter-continental ballistic missile system as well as spy satellites and sophisticated weaponry which could blow up the world a thousand times over. And NASA keeps telling us that what makes it all worthwhile is that it has provided us with the non-stick frying pan.

If war is the continuation of politics by other means then war-science is really the continuation of normal science and shows us much of the direction that research has taken. The Second

World War provided an opportunity for research that might otherwise have been difficult to carry out. How can you study the effects of chemical poisons, biological warfare agents, X rays, burns, freezing, and diseases such as syphilis, cholera, typhus, and plague? Oppenheimer and Fermi corresponded on the possible use of radioactive strontium 90 as a poisoning agent but Oppenheimer thought it would be worthwhile only if "we can poison food sufficient to kill half a million men." Churchill wanted more research into anthrax bacillus so that he could bomb German cities with it.

How does this compare with the quack vivisections of the Nazi doctor, Mengele? The war is still a fresh experiment in many branches of science. And many of the researches were to help the subsequent careers of those who carried them out. One horrific example of this is given in the Japanese book (The Devils' Gluttony, Sejichi Morimura and Mosaki Scimozoto, 1982). It tells the story of 3500 soldiers and civilians, including members of the Japanese Red Cross who, during W.W.II researched germ warfare and carried out experiments on live human beings which involved injection with plague, cholera, and typhus cultures, the freezing of limbs, infection with syphilis, prolonged exposure to X rays, and vivisection. In all, they are estimated to have caused the deaths of 3000 Russian Chinese and Mongols and a lesser number of Caucasians, all of them prisoners of war in Japan. After the war, while ex-Nazi scientists were being sequestered by Russia and the U.S., there was also interest in learning from the research developed by Surgeon General Ishii and his team of medical researchers enlisted from Kyoto University. This team had found a way to mass-produce penicillin years ahead of the Americans. In the research of vitamins (especially B complex), work was done by finding substitutes for human blood by draining veins and filling them with horse blood, while syphilis was studied by the vivisection of live babies born to infected mothers. The most valuable long-term research (according to an American scientist who arranged the deal whereby the whole thing would be hushed up in exchange for the research papers) was the exposure of human skin to X rays. Of course, this experiment, which Roosevelt and Truman had anticipated in the uncontrolled city laboratories of 'Nagasaki and Hiroshima in 1945, was then very much in vogue among scientists. All the top-ranking officers did well from this experience, and the data they collected aided their subsequent careers, some becoming part of the medical elite in civilian life. General Kitano became president, then chairman, of the Green Cross, a pharmaceutical company which in the 1950s developed the first artificial blood. Kitano, living in the bourgeois section of Tokyo, has handed over power to Ryoichi Maito, another leading researcher in Unit 731. Hisato Yoshimura was to become one of the world's leading authorities on human endurance to cold. At a conference of the Japanese Physiological Society in 1981 he proudly reviewed his life's research into comparative resistance of different races and age groups to extremes of cold. His data consisted of prisoners being soaked in cold water and put out in temperatures of minus forty degrees Celsius until the frozen limbs when struck by a short stick, sounded like "maruta" — a log of wood: "When these logs were soaked in hot water..the tissue crumbled." Much was learned about measuring skin temperatures, how long it takes to produce gangrene, how to treat frostbite. Yoshimura is, today, professor of the Hyogo Medical University and consultant for the Taiyo Fisheries Company. Some 450 members of the unit still hold teaching positions in medical universities. Scientific textbooks prepared during the Japanese "miracle of technology" were screened by at least two of the old Ishii unit.

Non-normal science? A wartime aberration? Clearly not, since the U.S. government carried out radiation experiments during the 1950s on unsuspecting military personnel 'and even (it is suspected) on entire American cities? Reagan's "Star Wars Technology" which was supposed to make the nightmare of a nuclear holocaust impossible by the development of even more sophisticated weaponry has squandered vast amounts of resources which could otherwise be used for the elimination of polio or malaria or finding a cure for AIDS.

Yet this is present-day ruling class science. Of course a more rational system could easily be imagined even under capitalism, and there are professional bodies of well-meaning scientists, both east and west, who wish to reform these excesses committed in the name of research. Whatever the usefulness of their work, both as pressure groups and public educators, they have set themselves an impossible task because to succeed they would first have to destroy capitalism.

# Chapter 4: The Marxist View of Science-Russian Roulette

> "It's not a bad system. The bosses pretend to pay the workers and the 'Workers pretend to Work."-Russian joke circa 1984.

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## Bogdanov and Science for the People

Scientists cannot ask if science is progressive if what is defined as scientific is called progressive. Marxists who claim a scientific means of understanding history are often powerless to understand their own history, especially when mistakes have been made. The rise of bureaucratic state power in the name of the proletariat meant that historical materialism had come to absolute power in the name of science.

Marx had absorbed much of the scientism of his own day into the body of his work and one of the main self descriptions was "Scientific Socialism", a term which both he and Engels used to distinguish it from "Utopian Socialism". Marx's endorsement of science fits into the $19^{th}$ century view of science as a progressive, even revolutionary force. Marx wanted to give the working class an edge on science; "Natural science will in time subsume the science of man just as the science of man will subsume natural science: there will be one science" (Manuscripts). But Marx also took the radical Hegelian view that the sciences "would be superfluous if the form in which they appear coincided directly with their reality." But essentially, most progressive $19^{th}$ century thinkers, Bakunin as well as Marx, saw science as a welcome antidote to religious obscurantism.

Scientism was already in Marx's thinking, especially in his economism, and was certainly present in Engels, who helped spread an almost religious notion of dialectics -the quantity-quality dialectic. This implied that if there was enough science then capitalism would collapse, as though obeying some natural law. Such dogmatism was to be taken up by Lenin, although in a much more pragmatic way and wanted to realise science without suppressing it. This can be contrasted to the religious rejection of science, which would suppress it without realising it. It was nevertheless disastrous for the old workers' movement that some of the utopianism (of say a Fourier, for example) was to be scientifically swabbed off as mere day-dreaming, though it often produced more humanely creative values than the rationality and scepticism of so-called scientific laws.

Alexander Bogdanov first posited the notion of proletarian science and his book "The Philosophy of Living Experience," (1910) laid the foundation for the Proletkult in 1917. In exile in Switzerland, Bogdanov eclipsed Lenin for a while inside the Party hierarchy. He was expelled from the Bolsheviks in 1909, most of the left-Bolsheviks along with him. It was at this time that

Lenin took the position of "partisanship in philosophy," rejecting and expelling all those with divergent views. The conflict with Bogdanov had already led to Lenin's main work on philosophy (Materialism and Empirio-Criticism), a work which was to become the Marxist-Leninist bible on such subjects as objectivity, epistemology, dialectics, philosophy of science etc.

By 1917, Bogdanov not only had views on proletarian art and science but had organisational plans as well. Proletkult claimed upwards of 400,000 members. As an organisation it sought to dictate in cultural matters as the party did in political affairs. While not opposed to the Bolsheviks, Proletkult agitated for a complete break with the bourgeois past by the establishment of "proletarian culture." The left challenge of Proletkult made Lenin assert the Party's rule in cultural matters. By 1920 Proletkult had been "attached" to the Commissariat of Education and virtually disbanded. Despite Bogdanov's obvious importance, his published work suffers from a kind of double censorship -the liberals censor him because he was a Marxist, while Marxist presses censor him because they are basically Stalinists. Since no English version of his work exists he is virtually ignored by those who repeat his errors.

It is the division of labour, writes Bogdanov, that causes knowledge to be broken down into its specialisation. "The Science of the Future" (the title of one of his essays) would not be fragmentary, but unitary. Philosophy was incapable of the task of unification because it did not produce the experience it tried to organise. "No effort of thought can gather and organise the parts of a shattered body into a living whole." For Bogdanov, the task "was the unification and integration of practice itself and with that, the merging of the special methods of science, which directly serve production, into a single, universal scientific method."

Bogdanov sees the unification of practice and knowledge as already under way, and he sees proof of this in increased automation. "Direct labour is done by mechanisms which the worker guides, and man's role of control and direction becomes ever more the order of things." He is convinced that the difference between the "implementary" work of the worker and the "organisational" work of the engineer will disappear, arguing that "when the supervision of such machines becomes the worker's main occupation. then every qualitative difference between worker and engineer will disappear and there will remain only the quantitative difference in preparation and experience … At this time, the worker will be more than an engineer, he will be a scientist.?' This science of the future, what he called the universal organisational science, would subordinate each division of science, specialities in knowledge drawing ever nearer to one another and universal methods . Labour could be unified only if the knowledge which labour used was unified. But this knowledge would be subsumed, along with the knowledge of natural processes, into a greater "organisational" science, a science of sciences. And the "organising activity" was to be the task of the proletariat.

Bogdanov was writing at a time when many were still impressed with the achievements of technology, which he regarded as the surest sign of human fulfilment. Thus there is total faith in the liberatory power of technology and no clear sight of its content. Machines have not freed man to become the "supervisors of machines" but have made some work harder and others live a survival existence on welfare. Bogdanov is heavily influenced by the strain of scientism and positivism which ran through Russian intellectual circles at the end of the century, one broadly influenced by a positivist Marxism. Although he himself thought that he had gone "Beyond Marx and Mach" (the title of a book by K. M. Jensen, published in 1944, the only book in English which gives extensive quotations from his work), he clearly remained in that positivist cloak which, with Bukharin, was to supervise the crushing of the Russian proletariat. Although Bogdanov was one of the first theorists to argue that the Bolsheviks had become a new ruling class (his name was to become associated with the Workers' Truth group), his concept of "proletarian culture" remained wooden and intellectual, as something decided for the proletariat and not by them. Proletkult was too quick to deny the importance of the cultural inheritance of the past. The use of "laboratory methods" divorced from real everyday existence made it unreal. It became another ideology, not for Lenin's reasons, but because it didn't allow for autonomy and spontaneity in creation. Science for the People was precisely that; for but not by the people.

"Bravo Comrade Lysenko, Bravo" — Stalin (1935)

The kind of model which took over in the Soviet Union after 1919, in which all power was hierarchically vested in a particular group, was doomed to collapse into the paranoiac machinations of cliques struggling for power over the workers' movement, finally crushing it. Manipulation, deceit, and murder is the normal business of rival factions of politicians and their police. In Soviet Russia rival factions have always used "science" to justify themselves and even occasionally to justify historical aberrations.

The stupidities of the Lysenko gang (Prezent, Vilyams, Kaftanov) have been so well documented elsewhere that it is unnecessary to repeat them at length here. Their notion of proletarian science stems directly from their notion of a proletarian state and their power could be maintained only through political terror since it lacked all theoretical or technical foundations. The reign of terror inflicted on Soviet science was disastrous for it.

For quite a number of years chromosome research was all but outlawed, relativity was declared reactionary and such important theoretical ideas, ideas which needed discussion at least, such as Bohr's Complementarity or Paulies resonance theory were likewise one-sidedly rejected.

So much has been written about Lysenko, generally from a liberal standpoint, that it is often forgotten how rotten was the middle class dogmatism of the Soviet Academy (an institution which had evolved from Tsarism). According to Lysenko classical-genetics, by its belief in the fatality of hereditary phenomena, by its denial of the fundamental importance of selection by adaptation by seemingly positing "an immortal hereditary substance "(chromosomes) which controlled the living organisms was idealistic since it apparently allowed no means whereby people could change themselves through changing their environment. For some, Lysenko appeared to be defending a radical Darwinism ensuring that the capacity for change lay within the power of human beings and seemed to provide an alternative to gene theory, which had been used so often in favour of racist arguments.

From the Leninist "partisanship in philosophy" to "partisanship in science" Lysenko took a blind leap. While Lenin merely implied that historical materialism was a science, in the same sense as physics or chemistry, and believed that his theory (dialectical materialism) was some approximation to it, Lysenko became convinced of it. It is essentially the same viewpoint from which current Marxist-Leninism claims its own little paradigms: Engels polemic against Duhring; Lenin's against Bogdanov; Gramsci's against Croce; Mao's against dogmatism. For the faithful there can be both historical certainty (science) and speculation (philosophy) though which is which is a question that can be resolved only by force.

Lysenko could find in Stalin's crude notion of dialectics a dialectic of evolution and a rush-job paranoiac study of biology on the run. Ironically, Stalin's statement (with Lysenko in mind) that "the history of science will become a science as exact as biology" was to prove true, though not in the way he meant it. Lysenko really was the hick who tried to pretend he had palace manners. Like Mendel, he was from peasant stock, rising within bourgeois institutions, the one to become an abbot, the other to become director of an institute, both convinced that their roots in the land justified their ideas. Both the priest Mendel and the commissar Lysenko became victims of the very dogmatic world views which nourished them, Catholicism and Bolshevism. What eventually triumphed was dogmatism and the denial of debate. Running science by experts in the name of the proletariat is not the same thing as the proletariat becoming investigators and researchers. By claiming that the debate was between proletarian and bourgeois science Lysenko was fictionalising but not going beyond science. There are no more two biologies than two chemistries or two physics; they are all a single science with, respect to method and content and historical evolution. The Lysenkoist name-calling dogmatism (Menshevizing idealism, Trotsky-Bukharin conspirators, Mendelist Morganists etc.) was merely a demonstration of the lack of argument and hid the egocentric conviction that as Stalinist Minister Of Education Kaftanov put it, "there could be no hereditary diseases in a progressive Socialist society, among the leading builders of communism." (The Rise and Fall of T, D, Lysenko, Zhores A Medyedev, 1969).

Khrushchev was to defend Lysenko even as late as 1963, (after the cracking of the genetic code and the discovery of the mechanisms of protein synthesis), calling him the "ideal Soviet scientists Lysenko's claim to glory during the early 1960s was his attempt to raise milk production through the cross fertilisation of pure-bred Jersey bulls with indigenous breeds (East Friesian, Kostroma., Kholmogory). Lysenko's farm at Lenin Hills' sold bulls to collective and state farms in order to raise the butter-content of cows throughout the Soviet Union. The farm was extremely fertile, well stocked, well funded by grants, mechanised (fifteen tractors, two combines', etc.) and did not have to produce grain for the state as it was a research center. The sale of low-pedigree bulls around the country ruined herds of higher purity and many had to be slaughtered Yet Khrushchev was able -to say, "When I want to find out about agriculture in the non-black-earth zone I go to T.D. Lysenko at Lenin Hills." Khrushchev had great praise for his Jersey bull programs and, in implementing them, almost destroyed Russia's cattle population. Lysenko claimed practice as his ace in the hole (although he also fancied himself a theorist), and most of his critics were at a loss to criticise his prowess at farming (many had never gotten their hands dirtied).

Liberal reformers like the chemist Semenov, or the physicist Sakharov, tried to bring reforms into the all-Union Academy of Sciences in the early 1960s. An article commissioned by the Central Committee and written by the petty reformist journalist Rapoport in support of genetics and so-called Mendel-Morganism was supposed to prepare the way for Khrushchev's forced resignation in October 1964. This article never appeared but within three months articles began appearing which disputed figures with Lysenko and led to an investigation of his data. Lysenko's methods were criticised for lack of controls, and it was discovered that butterfat figures had increased only through highly unnatural selection: the slaughtering or selling off of poor milk producers.

## Having One's Cake and Eating It: Cybernetics.

Any planned economy requires a steady flow of information between the planned units and the central planners. The question becomes, who should control this information and how to avoid bureaucracy? The Soviet economy, already large in 1917, had expanded to complex proportions by the time Stalin died in 1953, an accomplishment achieved only by a combination of political terror, Taylorism, and Stakhanovism, and the blood of millions of proletarians.

In the aftermath of Stalin's death a political struggle ensued as to what type of management Russia's economy was to have. The struggle was between two types of leadership, Party dictatorship or liberal technocracy. Malenkov, supported by a certain liberal intelligentsia, took over the government while Khrushchev took over the Party with the support of Party hard-liners. Khrushchev's Virgin Lands scheme, launched in 1954, involved sowing 32 million acres of wheat over two years by shipping 250,000 people, 120,000 tractors, and 10,000 combines to Kazakhstan and west Siberia. The people were mainly volunteers from the Komsomol, the Young Communist League. This was essentially a method of using the Party to attack the technocrats in the government, showing that the independent efforts of the Party (and therefore the people) were being obstructed by the bureaucracy of the Ministries. It was a struggle between two models of technocracy, one based on the historical scientific mission of the self-appointed Party and the other based on the principles of scientific management. Khrushchev temporarily won this battle over Malenkov but would finally lose out to a compromise situation, the Party absorbing the technocratic critique by 1964.

The decentralisation reforms which took place in 1957 were accompanied by a growing ideological shift among Soviet planners both within and without the Party. In this background cybernetics appeared to answer some of the complexities of planning. Borrowing from the entropy laws of thermodynamics, cybernetics hoped to circumvent class struggle by seeking to measure and control the amount of disorder in a system. In a country which had already embraced Taylorism as a panacea — even providing a workers' orchestra made up of factory whistles and sirens — cybernetics appealed as a scientific method and tool. By 1961 the Party had endorsed cybernetics research, and academician, A. I. Berg, set up the Scientific Council on Cybernetics that same year.

Loren Graham in his "Science and Philosophy in the Soviet Union" (1966) made the very interesting comment that "while in the 1930s it was possible to speak of the Bolshevization of science, in the 1960s it was possible to speak of the scientisation of Bolshevism." The age of the scientific manager had come to the USSR just as earlier it had come to the West. And, if in the West, there might be a feeling that "science had come to know sin," in the USSR science was shameless and seemed to provide the next logical step in the planning and running the country. The debate on cybernetics served as an ideological cover for an unadulterated leap towards technocracy as a managerial technique. From 1958 on, the entire literature and apparent openness of the debate was merely a means to make what had already happened politically and economically appear to have a scientific basis. While this cannot be put down to silly theses like "the restoration of capitalism" (capitalism had long been restored), it did however represent a new shift in capitalist planning through the use of information systems and scientific management.

In the west, cybernetic high priests (Norbert Wiener, Von Neumann, etc.) were working along similar lines and applying computers to economic and social planning and management. A 1963 report on the U.S. Sylvania Corporation could state: " In a revolutionary hook-up Sylvania has connected 51 cities to produce what a spokesman for the company called a step in 'administrative automation'…This form of integration secures many of the advantages of centralised control in decentralised locations, a feat which previously seemed tantamount to having one's cake and eating it too." The exigencies of the capitalist economy, East or West, had created the need for scientific management through the management of science.

Cybernetics would eventually lose ground to more clearly defined "information theories" and a new generation of yuppie commissars. The West's reliance on a commodity-spectacular society, in which information was required to have the appearance of "openness" was at odds with the closed and elitist structures of the Soviet model. It was not that large computers had developed more quickly in the West, they had also been a fundamental part of the Space Race, just that were developing under commodity capitalism. The propaganda section of United Technologies in the U.S. certainly understood the problems facing the Politburo when in an ad placed in many newspapers to bring in 1984 they wrote: "Orwell wrote at a time when computers filled large rooms. Only an army of experts could operate them. Only governments could afford them. If information is power then only governments would have the power the computer offered. What Orwell did not foresee was that information could be stored on a chip smaller than a baby's fingernail. Like ordinary beach sand chips are made principally of silicon — one of the earth's most abundant elements. That the chip has made the computer so widespread removes the fears coming from Orwell's belief that the power of the computer would rest exclusively in the hands of an elite few." Apart from the obvious banalities about the cheap cost of their sand castles, these propagandists pointed to an essential weakness in the Russian system.

In response to pressure from various reformist bodies (both in research institutes and in education), the Politburo was forced to computerise and share some of its information. The growing availability of the developing Internet made such restrictions meaningless in any case. They knew that for economic survival and competition in the world market they had to change, while on the other hand they know that to do so would shake up its monolithic hold on all information — even such basic statistics as food production, housing, etc., forcing them to share power with the younger apparatchiki of Silicon Valley. It had its effect on the production, storage, and even printing of information — the weak link in the Soviet chain. The older elitist model of the Kremlin, with its tight-fisted secrecy, was eventually to collapse. The rest, as they say, is history.

Historical materialism was only one scientific expression of what is progressive (where what is progressive is historical materialism). Another expression, much more dear to Western academics, is the notion of falsifiability. Since academics believe their ivory towers are outside of society, let us consider them separately.

# Chapter 5: It's Only Academic...

Much of academic history and philosophy of science shares the conviction that the central episodes in scientific development are revolutions. From Popper to Kuhn, from Lakatos to Feyerabend, through a host of lesser academics a lot of chatter can be heard about the concept of revolution in science. Against them are pitted those who defend continuity in scientific discovery, the idea that science merely adds more information and refines theories through a cumulative process. But what do these gentlemen mean by revolution?

## Karl Popper

According to Popper, science grows by replacing defective theories and knowledge progresses by conjectures controlled by refutations, in this way creating new problems to be solved. All theories, he argues, must be falsified before they are replaced. He cites the example that Europeans, for thousands of years, had induced from the observation of millions of white swans that all swans were white until the exploration of Australasia introduced a black swan. He also was critical of na've empiricist views that the world is objectively observed arguing that observation is coloured by world-views and understood in the light of existing theories.

Progress in science, he argues, although revolutionary, is always conservative; "a new theory, however revolutionary, must always be able to explain fully the success of its predecessor." Popper therefore is always in favour of the old theory, at least until it can be dismissed, of the old world view, which, according to him, can be only replaced if crucial tests show that this is necessary. Confirmations count only if they make risky predictions which cannot be accounted for in the old theory, such as the orbit of Venus for Copernicus or the bending of light for Einstein..

Thus existing theory is taken for granted. Empiricism still dominates because it is the test (which test? which jury?) that is crucial. Popper has really put the cart before the donkey in claiming that the onus is in rejecting new theories and defending old ones. He is the conservative who only changes when everything else has changed and there is no other choice but to accept it. What he provides is a program to test out the need for reform. His method is general and can be used for all theory; it can be used as an epistemology of reform. It is little wonder therefore that Popper has been so popular with political scientists and economists and has been used by Friedman, the economist who helped Pinochet's economy in Chile. It is interesting to note that the arch-ideologue of socio-biology, E.O. Wilson, dissociates himself from earlier biological determinists by accusing them of employing methods which generate unfalsifiable hypotheses, though exactly what this expert on insects would use as a Popperian test is still up for grabs. Like Bertrand Russell's chickens who woke up every morning to get fed but one morning woke up to have their throats slit, this pseudo inductivist might wake up one morning to a similar fate.

But even Popper had difficulties with the validity of the falsifying tests used and saw how, because of the tenacity of scientific theories (their tendency to evade falsification by the introduction of suitably introduced ad hoc hypotheses), simple falsifying tests might not be enough.

So he had to move on from a concept of naive falsification to sophisticated falsification. But what we really have here is the tenacity of conservative criticism, which by adding suitable ad hoc tests would falsify all the more. It is like playing a game in which your partner can change the rules anytime you begin to win. Popper's lack of dialectics, which makes him scared of negation, makes him religious: "In destroying tradition, civilisation also disappears and mankind returns to Adam and Eve," he writes, the stuff of the sermons of village priests.

## Kuhn

If, for Popper, science is always in a state of conjecture and refutation, for Kuhn this takes place only in periods of non-normal science, revolutionary periods. Kuhn posits the view that scientific questions are decided by a "totality of factors" (a paradigm) in which the meaning and direction of the questions are changed by a group of scientists, which then influences further courses of study. These paradigms are brought about by the necessity to resolve anomalies in the relation of existing theory to nature and are caused by changes of world view. Planck's discovery, for example, that light was radiated in "quanta of action" all of the same size, rather than as energy gave the first clue as to the true nature of light, previously thought to be waves in an ether. The change was revolutionary and dispensed with the need for a medium (ether) to carry the waves. It led to the introduction of quantum physics and the quantum was found to account for other enigmas. The Copernican Revolution, supported by the work of Tycho Brahe, Galileo, Kepler and Newton, shifted research away from an earth-centred universe, a major paradigm which gave birth to modern science.

Following these paradigms are periods of normal science, dogmatic interludes where everything is taken as being understood and given and the only valid activity is fact-gathering. In these periods the new world view slowly comes to dominate, as everyone is brought around to the new way of thinking. "The transition from one paradigm in crisis to a new one is not a cumulative process which merely adds bits into the picture," says Kuhn, "but a reconstruction of the fields most elementary theoretical generalisations." The conservation of energy as a theory could come into existence, he argues, only when calorific had been destroyed. Kuhn argues for far-reaching and drastic conceptual discontinuities and, unlike the continuists (Crombie, Hall, Toulmin, etc.), says that the development of science was not merely evolutionary but even punctualist evolutionary, a succession of paradigms.

Kuhn's 1969 postscript to his 1962 work was to react to the "scientific community's" criticisms. These ranged from the charge that no clear definition of paradigm existed (someone found 23 different definitions), that he was a romantic since he didn't analyse institutions, that no consensus in his "scientific community" had ever existed. Unfortunately Kuhn was to retreat under the consensus of his academic colleagues, who smelled something dangerous here, if not a defence of revolution (even a revolution of ideas) then at least the notion that the great instances of intellectual progress were beyond their control with the implication that these little academics might be involved in "normal" science. Kuhn was to posit a far less university-shattering view and move to the concept of micro-revolutions and mini-communities within the grand bourgeois community, thus allowing space for his conservative critics.

This allowed a convenient division into quantum and classical physics with the retention of the classical view. That the difficulty of accepting that the quantum had little objective evidence (given the Uncertainty Principle) allowed classical physics (the billiard ball model) to remain and in this sense paradigm shifts can be left open-ended- you can accept them or not. In many respects the only point of calling paradigms revolutions was to underline the fact that the argument advanced in any breakthrough always contained certain notional elements which went beyond logical or mathematical proofs. With this new concept of "disciplinary matrix" the major paradigm changes (Copernican, Newtonian, Darwinian, Einsteinian, etc.) were watered down. Instead of moving forward to sharpen the concept of paradigm by incorporating into it the absent parameters of class history and the needs of production, Kuhn was to abandon it altogether. His final version of paradigm changes reduced shifts in science into shifts in fashion, a useless, lifeless concept.

What Kuhn failed to realise, because of his lack of historical daring, is that what is needed is a paradigm in the real sense of a revolutionary paradigm, a break with the tradition of bourgeois science and the science of bourgeois tradition. The real paradigm is the proletarian paradigm which must create a new organisation of knowledge and its new collective application.

## Lakatos

In 1968 Imre Lakatos was to call student revolutionaries "contemporary religious maniacs" although he never actually called the cops on them as did the Frankfurt school philosopher, Jurgen Habermas. Lakatos could not accept Kuhn's critique of Popper that the decision to accept a new theory was not necessarily made by tests but by gestalt choices, even irrational psychological choices, because this could lead to the unacceptable view that major scientific changes had been the result of mob psychology. Lakatos introduced more piecemeal theory. Where Popper had spoken of a single theory, Lakatos now chooses to analyse a cluster of theories where each subsequent theory results from adding auxiliary clauses. "It is the succession of theories and not one theory which is appraised as scientific or pseudo-scientific. But the members of such series of theories are usually connected by a remarkable continuity which welds them into research programs." These scientific research programs are said to be progressive if they contain 'excess empirical content" which unearths some new fact. In other words the history of science is conceived not as steady progress punctuated every few hundred years by a scientific revolution but as a succession of progressive research programs constantly superseding one another with more enlightened theories of ever increasing empirical content.

With this everything is reduced to a methodology of research programs. Lakatos sees that if Popper's naive falsification criterion was applied to each theory it would never stand the test since new theories are usually inarticulate at the beginning. Thus, extending Popper's sophisticated falsification over a period in which there are various problem shifts, Lakatos continues to falsify the new theory and defend the old, but he also ensures that options are kept open and nothing that might be of help later is thrown out. If Popper was the arch-conservative, Lakatos is an example of cautious crisis management. He can then justify the role of the academic (which is what all academics want to do finally) in solving small problem shifts. Thus they can get on with their business.

In any case, the victory of one methodological research program over another is generally the outcome of a political struggle outside the universities, generally a struggle between different political ideas of capitalist management about the utilisation of resources, etc. Again which jury?

which test? Lakatos appears to be introducing history here, but really it is a static sequential slice of history, a boring history in which no one would want to live, because no one could breathe in it. He appears to be refuting dogmatic methodological rules (hence Feyerabend's praise for Lakatos as an "epistemological anarchist in disguise"). But the rules are written into the institutional parameters of the research program in the first place. Companies and the state will not give out money indiscriminately for any old research program and certainly not for one that might challenge its power.

All of the above gentlemen have an epistemology which posits a scientific community socialised into the traditions of its discipline. This community lays down the rules and procedures whereby it may subsequently be modified in some reasonable way. The communities are bourgeois institutions, the state as guardian and the university as home. Like Kant they feel that reason imposes laws and regularities on the world a priori and that there are categorical reasons for everything. The revolutionaries of scientific change are really just continuists who occasionally mention revolution.

## Feyerabend

Paul Feyerabend is in this tradition but stands out from it. This German ideologue has taken the debate from discontinuity to dadaism. "Kuhn's paradigms are so much hot air," he says, "and cannot be located precisely while Lakatos's methodology implies that all methodologies are equal." If Kuhn wished to incorporate out-of-date scientific theories as science rather than myth (after the style of Koyre), Feyerabend puts science into the world of mythology. In his main work "Against Method" (1974), he correctly demonstrates the propagandistic element that is a feature of all scientific discovery since Galileo. So science is dogmatic and is political and has lost the philosophical adventure it once had, it has turned into big business. Feyerabend then must ask two questions: whether science is worthwhile at all and, if it is, what kind of science. Here he oscillates between throwing science out the window and treating it as one activity among many. Anything goes, he says, everything is equally valid; the idea that there is no knowledge outside of science is another fairy story. In a remarkably irreverent article, "How To Defend Society Against Science" (Radical Philosophy 2, 1975), he writes "scientific 'facts' are taught at a very early age and in the same manner in which religious 'facts' were taught only a century ago."

But something is missing. Feyerabend has brought a healthy dose of dadaism to science and this allows him to be irreverent to rational being's most sacred ideology. But he remains only a dadaist, and a technocratic dadaist at that, because while suppressing science he leaves other institutions, though reformed, standing — the state and the university in particular. The dadaist suppression of art was limited. It did not know that it had not only to realise and suppress it simultaneously, but also to do so within the historical task of the abolition of classes. It is not just the "dogmatism" of science and scientific ideas that needs to be attacked, so that anything goes. Science is concrete. It reaches out and throttles you. It exploits.

For Feyerabend, the separation of state and science means less state control but not the abolition of the state. With a neo-Newman notion of the liberal university or research lab he asks to be left alone to do as he wants. "We shall develop and progress with the help of the numerous willing slaves in universities and laboratories." "Ideally," he says "the modern State is ideologically neutral" and, for all his quoting Lenin, Feyerabend doesn't wish to analyse it as a particular, historical instrument of class rule.

If all ideas and methodologies are equal, then they are equally useless or equally valid. No doubt Feyerabend's sincere aim is to avoid dogmatism and promote freedom. But here science must therefore be equal to voodoo, something which is true only in the repressive regime of Duvalier's Haiti. Even in Brazil where it may serve some useful purpose it is generally powerless against the onslaught of modernising tendencies. We should use all methods, all ideas, says Feyerabend and not just a selection of them, but how can we use the ideas of military dictators or Stalinist parties? Dadaism was only useful as a shock tactic and then only in Berlin where it partook in proletarian uprisings. Dadaism in art was forced to give way to a Surrealist program for precisely these reasons.

Feyerabend sees rightly that modern science is an oppressive, chauvinistic business in the control of ants parading as experts and that it has created a hectic barbarism. However, his aim is not critically to go beyond it but merely to limit its influence. Today, R. Mutts urinal is not just any old urinal for pissing in. If his dadaist "anything goes" is to be followed then capitalism goes, the organised obscurantism of religion goes, the power of capital goes. If modern science is Big Business, why should it go away and leave us alone?

Feyerabend's dadaism is really technocratic dadaism which, in the final analysis, is just technocratic liberalism and will revert back to technocratic dictatorship the minute any real non-spectacular attempt is made to change it. Then we'll see where Feyerabend goes. The road of ahistoricism is strewn with too many corpses already.

So if we are to find a way out of this dilemma there is no point in looking inside the universities. The realisation and suppression of science must find its theoretical roots if we are to be rid of its tyranny. But no matter how hard we look we will not find it in the universities, at least not among the lecturers and professors who know full well that they are on to a good thing, no matter how sincere they may seem. When what was once revolutionary stays around too long, it is the cruellest of masters, because it knows that it must now defend itself or be overthrown. Technocratic capitalism, and the theory which sustains and nourishes it, will find a hundred arguments to defend itself. And when there is no more argument it will find a hundred weapons.

# Chapter 6: What’s In It For Us, Boss?…

> “A great negation must be made of these things which smell of the grave. Say no to death and boredom, and you’ll keep a little life left. A little, freed, is enough. It will grow into a new and magical apprehension of people and things. Life will touch life and flower where it touches more marvellously than our state imaginations can believe”
>
> Jack Common 1935

Unfortunately, at least for the moment, the working class is divided, hierarchical, split into sectors and unions, with different pay-rates, perks, and benefits. It’s me and you, fellow workers, pitted against each other. And all the time self-determination remains elusive.

The capitalist organisation of technology is also external to the working class just as much as any attempt to reform it, which is the usual half-hearted reply to workers’ demands. The failure of the old worker’s movement was precisely the reliance on structures which did not arise within itself but were handed down as a means of emancipation by superiors. This heritage, bequeathed us by social democracy, Bolshevism, and anarcho-syndicalism, has to be destroyed as workers destroy the class system.

Knowledge really is power and power is knowledge, and the only way to ensure the defeat of the partialized power of capitalist knowledge is its total democratisation. However, in the atomised conditions of today’s world a little extra knowledge may mean no more than a few extra bucks a week.

The introduction of new communications and robotics technologies will intensify all of this. Aside from displacing thousands of workers from the workplace, it will create new relations of production, leaving only a specialised few with the power of destroying the economy from within the production process. Vast sections will become an undifferentiated, deskilled reserve army of labour and join the increasing ranks of the unemployed. Both groups will have to find new methods to work together, even co-ordinate actions. But we will have to find such methods in struggle and not accept anything handed down as some bureaucratic measure.

The 1983 IG Metall strike in Germany for the 35-hour week can hardly be called a victory. As a means to curb unemployment, the government had proposed to shorten the workers’ lifetime by a system of compulsory early retirement. Some hundred years since the beginning of the struggle for a 40-hour week, the IG Metall union put forward the idea of shortening the 40-hour week because this was the only way it could sell itself to its members and get some sympathy. The strike ended in a compromise of a 38.5-hour week with no loss in pay. Most workers supported the strike, because they knew it meant an increase in hourly wage rates. Workers carried out overtime as before and the hourly rates were adjusted upwards, that’s all. And in fact most plants retained the 40 hour week, giving extra holidays or winter holidays. The net effect has done absolutely nothing to ease the imbalance between employed and unemployed.

Under today's conditions 100s of thousands are uprooted, pushed into a little bit of education, given some apparently classless culture and then forced out onto the modern death-ships of worklessness and meaninglessness. Many of the transplanted begin to see things more clearly than those left in their original soil.

Sometimes a wild guess is worth a hundred carefully prepared theses. But, as Galileo understood, a hatred well thought out is worth a hundred wild guesses. Science in the last century was what was needed against religious obscurantism; it helped break down the mystical tyranny of the upper classes. Yet today, with science everywhere, with scientific food, scientific architecture, scientific sleep, science in the cupboard and science down the toilet bowl what we need is less science.

Working in your back kitchens while you sip your cocktails or shop at Tiffany's or Harrods we plot your demise. And if we don't, then more fools us for being voluntary slaves. The struggle for the 40-hour week is over 150 years old. One nuclear submarine could keep a clinic going for 15 years. But all of that means nothing; it's too logical, too simple, unscientific.

At present workers are considered an extension of the machine; in fact, more care is taken of the machines than of the workers. Workers are forced to do compulsory overtime so that maximum use can be made of the costly equipment; there is a definite drop in the quality of work life, with increased job pressures, more isolation, less control over work procedures or even the quality (or any other characteristic) of the product being made.

Under today's conditions, employed and unemployed eye each other nervously. There is the provocative example of the Spanish workers in the period 1976–1978 where unemployed workers were invited to factory meetings by other workers and given the power to vote. Such things do happen, but only in times of large offensive struggles. In times of reflux, there is the stony silence of separation. In 1981, spontaneous riots broke out all over the U.K. and the kids in Brixton rioted all weekend. When it looked like Sunday night's rioting would overflow into Monday morning's work itineraries, the police moved in quickly and with more force than they had ever used before. They realised that if employed and unemployed got together, then that was a major threat to their power.

The question is how the unemployed can reach the employed when the technology is keeping them apart. Technology will have to be subverted before any steps can be taken. In all occupations of factories, workers' control of industry will have to raise the problem of redesigning the means of production, probably by setting up proletarian information centers where new ideas can be tested and where there will be a rotation of tasks. The universities can easily be dismantled and much of their laboratories and equipment reassembled for use in these proletarian information centers.

Workers in the new high tech industries will have to begin to demystify these skills with all others, cutting out the jargon and other effects of specialisation and explaining how things work so that tasks can be rotated, to transform the specialised skill of each so that it can be done by all who wish to react to the challenge of redesigning machines to alleviate as much menial work as possible.

There is also the problem of redirecting design under the present social relations. Where to begin? At the metal goods factory Duarte-Ferreira in Tramagal in Portugal over the period 1974–1976 a similar sort of situation arose. The company was taken over by its 1500 workers and the production of Berliett tanks for the colonial wars was suspended immediately and some 500 army trucks were redesigned for civilian use. The actual design and the plans for the design were discussed in an open assembly of all workers. The design of a heavy duty tractor was also put up on the walls and all workers in each section, welding, riveting, etc., were asked to correct it and make suggestions.

There are many practical problems here. The experience of Lucas Aerospace in the mid 70s is a case in point. The company which supplied mechanical and electrical systems to the aircraft industry had a workforce of 13,000 in 1974, including 2000 engineers, draftspeople and technicians and the workers were generally highly skilled machine operators. After some 5000 workers had been fired over the years 1970–1972 due to both a decline in aircraft spending and the need to introduce labour-saving technology, the Lucas Aerospace Combine Shop Stewards Committee formulated a detailed multi-volume alternate corporate management plan. This plan demonstrated the differences between specialists and workers in no uncertain ways and points to the problem of attempting to redirect production within the prevailing capitalist social relations. Both must change at the same time if it is to be successful. Workers were asked to redesign life and machinery. Thrown unto the vacuum of classlessness for the moment, they didn't know what to do. The two aspects of work and getting out of work are contradictory, but we are all little boys and girls who want to run off and play.

Lucas Aesospace had little of this adventure and hardly any Luddism, which seem necessary given the social relations. The Committee sent out a questionnaire to every branch of the combine resulting in thousands of replies, which were finally watered down to 150 alternate commodities. Priority was given to use-value rather than the "market." Thus designs were forwarded ranging from a gas-fired heat pump to kidney machines and energy-saving devices — an ideology of alternative energy was running through the entire operation. Some of the pieces were carefully produced in the factory and were assembled and tested at North London Polytechnic where a center for industrial and technological alternatives was set up by the Combine Committee and the Poly. Links were established with Birmingham University, where "alternative" economics was taught by leftist lecturers. It was an affair of specialists, managers, and trade-union elite. Most workers, while they may have shown some interest at the beginning, soon lost it, the primitive fear of unemployment being more important than anything else. In the end, of course, the alternate plan had really nothing to do with workers' control of technology and was really designed to smooth out the necessary restructuring at Lucas. The American (IAM-AW) trade union plan "rebuilding America" is in a similar vein.

Mike Cooley in his "Architect or Bee: The Human/ Technology Relationship" (1980), written while the Lucas Aerospace struggle was still going on, writes: "We believe it is arrogant for aerospace technologists to think that they should be defining what communities should have. The Lucas Aerospace workers are deeply conscious that if the debate were limited to industrial workers of this kind, it would represent a new form of elitism…Therefore, we are seeking through trade unions, political parties and other organizations in each area, to get people to define what they need and to begin to create a climate of public opinion where we can force the government and company to act." Whatever workers thought they were doing the university lecturers like Cooley and others used this larger "we" to stifle grass roots creativity and dissolve it to nothing but a social democratic bad taste. The problem here is the kind of upper-class clout which the university lecturers and the "experts" have and which can result in a kind of fatalism for everyone else. The loyal bees must surely know what they are doing with so many years of study and so much expensive equipment given to them by the government. Surely the government wouldn't trust them if they didn't. We who run the machines know nothing about them.

The problem was that the workers were unable to face the specialists from a position of power and therefore had to lose from the beginning. Instead of taking the factory to the university they should have taken whatever expertise they needed into the factory. There they would have been on safer ground, would have had more self-confidence and could have had more control. The organisation mirrored the division of labour; the 2000 professionals had more input and the shop stewards elite ran the whole show. Bakunin had had the right inkling when he wrote: "In matters of boots I defer to the authority of the bootmaker; concerning houses, canals or railroads, I consult the architect or engineer…But I allow neither the architect nor the 'savant' to impose his authority on me…It is life, not science that created life and only the spontaneous action of the people can create liberty."

But the questions are very real and pragmatic and will arise again and again. What relationship could there be between those whose technical knowledge could help and those who want to change the world? Perhaps there is no hard answer here; in its own time the proletariat will know who its friends are; its enemies will surely know. Self-organisation must exclude all those who care more about their own careers than the abolition of capital. In Spain the Assembly Movement threw out the unions and political parties from their assemblies (see "Wildcat Spain Encounters Democracy 1976–78" -London/Lisbon, 1978–79). By insisting on their own ability and creativity workers subvert one of this society's basic tenets -the need for experts, whether they be experts in science or in revolution.

In Britain the TUC has been training specialists in technology for some time with the idea of having specialist negotiators. For them, the essential is getting the situation to run smoothly. This may require a little tinkering with the circuitry but no more. This, combined with the fact that the whole project seemed to have been taken over by experts at the universities, insured the disinterest of the Lucas work force.

It was not completely negative and some workers got a sense of self-determination and power, however temporary. Perhaps it would be worthwhile to start setting up these proletarian information centers already, or at least to start asking what would be fun to do at our own work and leisure. To dream a little with the machines which surround us so that one day these machines can let us dream softly. Today I think I'll go and make cars. Yet capitalism and wage labour must be abolished or made redundant before any such dreams can have real content. Probably much of the design of the present machines would have to be changed to allow for more flexibility and communication among workers. It is only when people feel pride in their work as an extension of their pleasures that self-determination can reign.

Small signs give us an indication of the future sometimes. In Nicaragua, a "movimento dos innovadores," was set up whereby workers could bring in their own inventions and technical knowledge to a central pool. Of course, American or Russian workers, while they have much to learn and to gain from struggles in underdeveloped technologies, cannot base themselves on these experiences. To do so would be to ridicule these struggles. Even if a good portion of middle-class intellectuals in advanced countries might fantasise otherwise, you cannot mimic the past. You can only push out the limits of the present into the future, destroying these limits, where possible, attempting a future in which it might be desirable to live. If we are to respect the "impossible" attempts of Nicaraguan or Salvadorian or Filipino workers towards reinventing uses for an outdated and oppressive technology then we need to show that we can do likewise.

The day when workers can run away and play secure in the knowledge (our own knowledge) that the machinery is running because we have rigged it up to our own liking is the day when wage-labour becomes unimportant and the social impulse is to the creation of classless values. Only then can a machinist take over the machine as its author and not its slave. Only then are we all researchers and research works for us all. And we must begin somewhere.

# Chapter 7: The Realization and Suppression of Science

> "The earth centred approach to the problems of the planets is hopeless and the traditional Polemic astronomy has not and will not solve that problem; instead it has produced a monster, there must be a fundamental error in the basic concepts of traditional planetary astronomy."

## Copernicus

The old workers' movement which was moulded by Social Democracy, Bolshevism, and Anarcho-Syndicalism, is dead. No amount of science will resurrect it. We know science will not and cannot solve the problems of a modern proletariat because it is impossible for it to deal adequately with our desires, our goals, and our search for an organisation of knowledge which would match the autonomous organisation of a classless society. Instead, a monster has been produced.

From the introduction of the idea of progress by the bourgeoisie, up to the point where they were no longer a progressive force but rather a decadent one, many has been the philosopher or poet who has sought to unify art and science which was felt to have been forced along different paths. From Leonardo (the craftsman who really did possess the knowledge and curiosity of both) up to Ibsen (who mourned their separation without understanding their reason) to the modern art/science trained cadres in their specific fields, the historical project of science has been criticised from partial positions. Usually this has focused on some aspect of the theory of the "two sciences", an idea Bogdanov is responsible for. Like the development of art, from the romantics to Lautreamont, which finally imploded in dadaism and Surrealism this has followed a zigzag pattern but can begin now to achieve theoretical coherence.

There is a unified proletarian theory, as opposed to science. But it exists only as a tendency. It does not exist outside the practice of the proletarian movement. It has a history but that history has not yet been asserted and exists only as a fragmented memory, calling up little bits here and there. It distinguishes itself from science in its form and content and grows with struggle. It does not exist a priori in the realm of experts or in their training grounds, whether it be the unions and the universities. However sincere some of these experts might be, they will eventually be lost in its deluge.

The developing proletariat will have to realise and suppress the bourgeois organisation of science, while at the same time creating its own organisation of theory and a theory of organisation, which it presently lacks. The call for the simultaneous suppression and realisation of science must not be confused with anti-science. Nor for a call for a "science for the people." Self-determination "for the people" can only leave the people as spectators and not creators. Research will be necessary, but as an activity dictated by desire and proletarian needs, not some interpretative careerism. When society is forced to change its needs away from the creation of surplus value, then its research needs will change accordingly.

Young hackers, those who feel a joy in subverting technology and using their own knowledge and very real creativity, have much to teach us. To hack with a sense of history, to put our minds to the real task of hacking away at capitalism, whether at work, at play, within miseducation or education: there are countless possibilities yet to be discovered. Putting our brains to work on those possibilities is a part of the modern creative process and one which some have already taken on.

Shock tactics may be necessary at the beginning. The constructivists and Workers' Truth group in revolutionary Russia shocked Lenin by saying that they would put all the old masters on the barricades to defend the revolution. In 1968, in Canada, a computer was thrown out the window during a student occupation. A small group of Maoist workers took over an experimental nuclear power plant in Portugal in 1975, surrendering it immediately afterwards, basically because they didn't know what to do it. (Probably nothing could have been done with it, other than to resort to terrorism, something they did not want to do, or dismantle it.)

This is not to advocate a "scientific" dadaism. Shock tactics can only work in the short term but cannot win the war. The realisation and suppression of science must create its own organisation of knowledge. This is the road which leads to the abolition of classes and all class institutions — whether workerist or bourgeois (trade unionist or social work). The issue is dialectics and the cruel parameters which reach into the everyday lack of autonomy. The understanding of why things happen about us, why what we want does not happen and why we feel powerless to make it happen, and what forces are behind this? We should be our own researchers and investigators in the immediate world about us. To love is also to know and real learning takes place only when you've actively in control.

Academics should not find here any future for themselves. I expect them to treat this text with the same contempt I have for them. But proletarians — fellow animals — might feel freer to experiment and do their own type of research for the final undoing of this capitalism which has gone on for too long.

Boy Igor & Phil Mailer
And Yet It Moves (Updated Edition)
The Realization and Suppression of Science and Technology
1985

<files.libcom.org/files/2022-10/AndYetItMoves.pdf>
A situationist critique of science and technology published in New York in 1985. This version is a new edition that was published on the 'Endangered Phoenix' website and credited to Phil Meyler. The Endangered Phoenix website is dead now, and I can't find the updated version on the website through the wayback machine, so there are some footnotes and chapter heading levels which are unclear to me. Plus, I think chapter 3 & 4 were merged in the updated edition, so chapter numbers went out of sync, but chapter 8 was still called chapter 8 which makes it seem like chapter 7 is missing on the libcom website. It is all very confusing, but I've changed the chapter title that said 'chapter 8' to 'chapter 7' for now.

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