From Necessity to Freedom

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> *"With society's takeover of the means of production, anarchy within social production is replaced by conscious organisation according to a plan. In this way, in a certain sense, man definitively separates himself from the animal kingdom and passes from bestial to truly human conditions of existence. The objective, extraneous forces that have hitherto dominated history come under the control of men themselves. It is only from this moment onwards that men themselves will make their own history with full consciousness and the social causes they put into action will have the effects they intended. This is humanity's leap from the realm of necessity to the realm of freedom" (Engels, Socialism from Utopia to Science).*

He's Not Human

We warn the reader that this article is an apologia for the machine, or rather, the machine system. In the society of the future, it will certainly be possible for those who wish to do so, to return to live like a Neanderthal in the time of primitive communism, but the prevailing social characters will be those of high technological density. The inhuman visible technology of today will be replaced by a human metabolism regulated by invisible sensors and actuators. The use of a minimum of equipment will be the result of a maximum level of their intrinsic qualities. Yet there are still some who mistake the increase in social productive power for an increase in production. The society of the future will happily forget the age of productive quantitativism and will tend to bring dissipated energy into harmony with the energy that the sun gives us. But the latter must be captured.

Let us start with an elementary consideration: in this age of transition, technology is so invasive that it heavily influences man's consciousness of himself. Instead of feeling liberated from fatigue and alienating or dangerous tasks, we consider ourselves slaves to forced labour performed by machines that are masters of our destiny. It is clear to everyone that the substantial difference between man and any other animal is the ability to produce artefacts according to a plan, that is, to produce according to a desired result known in advance. But it is not as clear what follows. The kind of artefacts that best respond to this concept of 'anticipating a future' are those that serve to build other artefacts. Machines are the product that most humanises man, according to Marx's observation on man-industry, i.e. the true anthropological dimension, not yet metabolised by our species due to the continuation of capitalism. Yet, as Marx put it, man continues to feel more human in his animal functions, when he eats, drinks, copulates, competes, sleeps, than when he does the only thing that distinguishes him from the beasts, that is, when he 'works' and produces socially, according to a plan. It is not human to go so far as to manufacture

machines that tend to mimic our behaviour and ape our intelligence and feel dominated rather than liberated by them.

The historic advent of automatic machines and actual robots in the world of production should not be interpreted simply in the light of the 'trade union' implications of the closure of the least productive factories and the consequent so-called technological unemployment. It is a phenomenon that must be placed within the broader process of the enfranchisement of man from processes that are beyond his control and which therefore enslave him since the direct relationship between man, what he produces and the tools he needs to produce has disappeared. If by 'freedom' we mean the ability to have control over one's existence, both individually and, above all, socially, we must admit that today this control is less operative than ever. Very powerful means would allow us an existence free of misery, but capitalist man is not able to use them by directing their power to the solution of problems. On the contrary, it seems that the more he struggles to find solutions to the problems of our time, the more he gets entangled in blind alleys unleashing the inhuman part of our species.

This inhumanity has nothing to do with morality, love of neighbour or charity: it has to do with the blockage of the humanisation of the primate homo on his journey from prehistory to history or, as Engels puts it, from necessity to freedom. Automatic machines, by freeing up life time, contribute massively to the growth of a new need, that of making the leap into a completely different society, where work time disappears to be replaced by life time. And this is not a contingent phenomenon, which can find its equilibrium once a certain level of machinism is reached; there is no limit, the process of automation is an essential condition for capitalism, not an optional extra for some capitalists. Therefore, the elimination of forced, wage labour is irreversible and prepares the time when humanity will do without it.

In the distant past, liberation from necessity and the march towards freedom would not have been conceivable. Up to and including classical antiquity, it would have made no sense to make a distinction between fate and will. It was only in the Middle Ages that the idea of a dualism between a fate under the control of divinity and a free will came forward to explain and justify the existence of sin. The bourgeois individual has its roots in the Middle Ages, it is therefore older than the bourgeoisie as a class, but it is only with the latter's coming to power that it idealistically unfolds all its social characteristics. With the bourgeois Enlightenment revolution, fate disappeared, replaced by determinism and mechanics; while the will, i.e. freedom, became the prerogative of the citizen who had acquired political rights, preferably by revolutionary means leading to democracy. The latter was no longer the prerogative of the ruling classes, as in ancient Athens, but power distributed under the motto 'Liberty, Equality, Fraternity'. Freedom became the prerogative of the People through individual rights.

All this came to an end very soon, even while the national bourgeois revolutions were still in progress. Today, in the midst of the decadence of the ruling class, any reference to freedom is even ludicrous, given that the claims of the various social components relate to far less ideal and more prosaic issues. Therefore, it is necessary to de-semantitise the old term and strongly reiterate our meaning, which is that of the title and the quotation that opens the article. There is no need to emphasise that the key to the whole 'from → to' process is the collapse of the capitalist system and the overthrow of the bourgeois state through the emergence of the party, so let us refer back to the theoretical heritage made available by the revolutionary movement and try to understand, given the conditions of class relations and increasingly socialised, globalised, automated production, what is actually boiling in the pot beyond immediate perceptions.

The Modular Social Brain

In a mature capitalist country (but the new upstarts are also maturing very quickly), the typical proportion of GDP is around 25% for industrial production, 5% for agriculture and 70% for services. No one is surprised: it is considered a normal fact that automation changes the nature of the production process, that wage earners expelled from industry and agriculture move to sectors producing intangible goods, and that production spreads across the entire planet as a product and factor at the same time of the growing social division of labour. But it is considered a social evil that expelled wage earners move out of the working class and into the industrial reserve army first, then into relative overpopulation, and finally into absolute overpopulation. Instead - it may seem a paradox - it is a revolutionary fact: it is closer to communism the country that liberates more labour, not the one that liberates less. Is it 'the fault' of the machines? Are we not witnessing man's daily abdication of his prerogatives as 'king of creation'? Didn't Marx also say that the machine, or rather, the machine system, turns man into its appendage, a mere guardian without art or part? Only a degenerate society can think that machines are like a ruling class, inherently capable of subjugating men.

In the 'science fiction' section of fiction and cinema, there are thousands of works dealing with machines, loyal to man and more often rebellious, capable of being self-sufficient and attacking the freedom of humans or even subjugating them as in Terminator or Matrix (see the extensive list in List of fiction to robots and androids on Wikipedia). But the machine does not have the ability to be free, it does not design itself, it does not anticipate forms to come. It may be that in the not-so-distant future (100 years says Stephen Hawking) it may be able to emulate the human brain, but for now the concept of the machine as a prosthesis of human faculties still applies. A good example comes to us from industry: the acronym CAD, Computer Aided Design, tells us that the machine,

with its powerful but primitive intelligence is our assistant. If, in the production system, which is a system of machines, the opposite occurs, it is certainly not through the initiative of the machine.

Today it is possible to design and build machines that can assist man to the point of completely replacing him, which is very useful, especially in alienating or dangerous operations. Go and convince an Indian electronic component assembler that it is a good thing to accept a starvation wage in order not to be replaced by a robot that could instead free him forever from that mind-numbing job. Go and convince a Chinese miner, whose comrades die by the thousands every year, that a robot digger would be a disgrace to mankind if it extracted minerals from deep shafts, turning working time into living time instead of unemployment and misery. The machine is therefore not just a more or less complex tool that gives some work to trade unionists and sociologists and takes a lot away from workers. It is a key element of social change: nothing like the machine evokes a society in which exploitation no longer exists. You cannot drain surplus value from a robot, it is wrong to imagine the persistence of capitalism in a world where production would be completely automated.

It has long been stated that in human society, the individual brain is a module of the social brain. In the same way, every machine is part of a system and represents a module of it. It was true of the steam engine whose power was distributed by belt-driven systems. It is true for the electromechanical machine that connects to the power outlet as the terminal of a network. It is all the more true for the electronic machine that by its physical constitution is a node in a network that does not merely convey energy but makes information 'work'. Having reached the stage of the electronic machine, it becomes possible and almost natural to compare it with the human brain, with due attention: every possible analogy stops at the border between the mineral world and the biological world, which is like saying between the discrete/digital world and the continuous/analogue world. While it is true that digital processing can simulate analogue behaviour, it is not true that this simulation authorises us to wait for the advent of a robot that is a clone of our organic faculties. Which is by no means indispensable for the growth of an artificial intelligence. In the previous article, we mentioned Turing's Virtual Machine, pointing out that it essentially represents the transposition of our analogical, continuous thought into discrete steps capable of solving any computable problem by repeating the operation the necessary number of times. A number that is finite, and such a limit could prevent the solution of every computable problem. But a Turing Machine can be inserted into a Turing Machine that has in turn inserted a Turing Machine, and so on. This synthesis between the analogue brain (ours) and the digital brain (the computer) is only possible by keeping the two computing organs together, which means that in order to obtain super-performance from the biological one, one must use the mineral one, and in order to obtain super-performance from the mineral one, one must employ a human operator who understands the problem

to be solved and writes the programme capable of exploiting the machine's performance.

The machine alone cannot simulate the brain in all respects. It is a problem related to thermodynamics and information theory. For the computer to be able to replace the human brain, the machine must be able to reverse the natural cycle in the same way as man can. It should, for example, overturn the deterministic chain of the Turing machine. Within a given system, every deterministic chain is oriented in time: left to itself it goes from order to disorder, from the least probable situation to the most probable one, as would happen in the house we live in if, starting when it is new and newly furnished, we did not tidy it up every so often. The action of 'tidying up' involves feeding information into the system that has gone into disarray. But if the computer works deterministically, how does it 'tidy up' data from a lower order?

When discussing these topics, it is almost inevitable to resort to the proverbial 'cup example'. We put our house in order and thus do a 'local' anti-deterministic operation, but in doing so we drop a cup and it breaks. The second principle of thermodynamics tells us that it will be very, very unlikely that the cup will reassemble itself, unless we 'tidy it up' as we did the house, collecting and gluing the shards together. It is an operation that even the machine can perform, there are no theoretical limits: each fragment is analysed by means of a vision apparatus, shapes are configured according to a three-dimensional grid, full and empty spaces are made to match, etc. etc. If desired, an assembly line robot can be used to physically glue each fragment together. That's all well and good, but at this point it is natural to observe that the machine does this because it is programmed by man. In reality, the machine could program itself: just as there are no theoretical limits in solving computable problems, so there are none in the use of information collected, stored, processed, implemented. Only, this process takes the form of co-evolution of brain and machine: the brain has 'informed' the machine which, by operating, teaches the brain what to do, and how, for the next step. From the point of view of logical systems, man first started to produce something, and from then on he has always had to deal with feedback, like a sorcerer's apprentice. Capitalist man is a patchworker of critical situations that he himself has produced. With the development of capitalism, social complexity has grown so much that the management of various processes has become extremely problematic to the extent that they often, in many ways, get out of control.

Let us see in detail what is happening.

Bigger Brains

There are individual human brains that, using electronic brains, amplify their own processing power through machines. At the same time, a great social

biological brain has come into being, made up of many individual brains, which uses the planetary network of machines; in doing so, it not only amplifies its own processing power but also realises an organism of a higher order, a neo-organism, capable of both processing information and producing it. The effect is disruptive: the individual brain plus the individual computer (personal) becomes a bio-technical machine whose control centre, for day-to-day activity, resides in the consciousness of the individual, a situation that allows the idealistic illusion that so-called free will exists to be cultivated. In the case of the social brain, on the other hand, there is today no control centre, no collective consciousness that centralises decisions and cultivates a theory of free social agency. To the extent that such a consciousness did exist, it would certainly be a historical product of the revolution in progress, a power capable of assuming a formal arrangement and manifesting itself not obviously as a repository of free will but as a vehicle for that 'overthrow of praxis' with which we are so concerned. It could be (or: certainly will be?) the 'phenomenal form' through which the historical and formal party manifests itself. Going about their daily activities, most people have not yet realised what it means that the Net has become so pervasive that it has absorbed 100 per cent of transactions between industries and services, almost 100 per cent of telephone communications and almost 100 per cent of production and logistics activities, with 4 billion computers installed (but a smartphone is also a computer...). The prevailing standardisation does not allow the generalised assimilation of such a party concept, but it is the very maturity of the current economic-social form that imposes it. Herbert George Wells wrote:

> *"A clarifying universal organisation of knowledge and ideas, that is, the emergence of what I have called the World Brain, will replace our multiplicity of uncoordinated ganglia... in that and in that alone, it is certain, there is the only clear hope of finding a Competent Administrator for world affairs. We do not want dictatorships, oligarchies or class rule, we want a world-wide, self-conscious intelligence" (The World Brain, 1938).*

Could be, we said. Let us keep the conditional, but it is certain that the evolutionary process of the two brains with prostheses, the individual and the social one, is far more advanced than official studies can reveal. The material basis that could make one opt for this process of party formation (rather than another) is revealed to us by an elementary investigation into the functioning patterns of the aforementioned individually and socially improved, enhanced brains. The processing machines that enhance the biological brains in the two systems are the same: their internal control is provided by a unique programme that 'runs' on a von Neumann machine with a constant architecture (boot memory, mass memory, programme, volatile memory, data input and output, ergonomic interface, etc.). The programme strings that process the information are given, just as the material apparatus is given. The computer may or may not work, but it cannot deliver surprises, 'do things' for which it is not programmed. It is not capable of overturning practice at any level. Its silicon or bit cells do not

have to worry about what is going on, where the energy that powers them comes from, what is happening in the environment around them with which they only interact if they are ordered to.

The cells of our brain, like those of the rest of the body, are very different. Of course, they too are conditioned by being part of a whole, by being destined to be born and die all the time in order to perform just a certain specialised job so that the whole organism functions. But, as we have seen in the previous article, they are the descendants of single-celled organisms (prokaryotes and eukaryotes) that, at the dawn of life on Earth, had not yet learnt to aggregate into complex assemblies. They floated in a liquid environment 'deciding' where to go depending on whether or not they 'felt' the presence of 'food', trying to survive at all costs when 'external' agents threatened their existence. To do this they had to develop capacities, senses, primordial knowledge. And each of these cells was naturally predisposed to theorise in the smallest terms about its own free will: 'food yes, food no; let no go and go towards yes'. The eukaryote could not have known that its free will ended where the deterministic, material arrangement of the sugar gradient began, where millions of cells of the same type moved chaotically, all striving for the same result and thus generating ordered flows emerging from disorder. Our cells eventually specialised and sedentarised, our neurons developed trillions of synapses and we still 'feel' that we do what we do because we want to. And we absolutize the little bit of truth in this to the detriment of our being 'social atoms', a condition that, examined by the method of physics, is far more interesting and promising than all theo-philosophical disquisitions.

Artificial Intelligence and Design

Assuming and not conceding that the human-like processing capacity of an artificial brain depends on a number of components approaching that of the biological neuron-synapse system, we are still a long way from matching the 1015 natural synapses, each of which can be artificially simulated with a hundred or so components (logic gates). From a purely quantitative point of view, therefore, the biological brain seems to have an advantage, bridged perhaps, but with many difficulties. An artificial brain quantitatively analogous to the biological brain would have the advantage of the switching speed of the components, which can be measured in nanoseconds, whereas the response time of neurons is in the order of milliseconds, i.e. a million times as long. However, whereas in the computer the processes are sequential in time, in the brain they are parallel and make use of widespread relationships between cells through an 'associative' memory, i.e. capable of connecting fragments of information and processing them simultaneously. This, according to neuroscientists, would make a substantial difference, according to some of them absolutely insurmountable. Not least because the human brain dissipates an energy of 10-16 joules per operation per second, while the artificial brain, as

things stand, dissipates 10-6, ten orders of magnitude more. This means that in order to obtain a processing power similar to that of humans, a computer would absorb an immense amount of energy, forcing it to distribute the processing over thousands of processors in order not to see them vaporised in an instant. This route has been tried.

Despite the fact that the biological brain is of a complexity that is not only difficult to reproduce but also to understand, an attempt has been made to simulate what little has been discovered with so-called neural networks. Thus, an attempt was made to create machines capable of processing data not according to sequentially programmed instructions but in parallel, favouring relationships and associations, just as neuroscience had found to happen in the biological brain. In this way, interesting results have been achieved from the point of view of computer architectures (which, however, remain fundamentally von Neumannian, see previous article), but any ambition of integral simulation has practically fallen by the wayside. On the one hand, the workings of the biological brain provide information that can be statistically processed with the methods of physics, and are therefore useful both for their implementation in machines and for their ability to inform us about the brain itself; on the other hand, they provide information about the limits of simulation. The computer, for instance, cannot solve problems without being provided with computable and numerical information, it cannot provide answers on 'fuzzy' problems. In such a situation, which is far more complex than it appears from the summary we are making of it, it clearly emerges that human-machine interaction triggers evolutionary processes precisely on the human-machine pair.

Having relegated research on 'strong' Artificial Intelligence to a niche position, research on solutions made possible by man's use of computers is making its way. In short, the use of computers as a vehicle for discoveries on improving the use of computers. Let us think about our 'fractal' conception of the stages of social evolution and we will also find traces of this in the relationship between man and machine: an individual with 'his' personal computer, smartphone, tablet, etc. etc. connected to the Net is a fractal of the whole of mankind with its computers etc. now living on the Net.

This does not seem trivial. We are in the realm of man's own evolution since the hand-brain-language nexus has produced us as a new species within the primate order: the computer, which was at first a means to solve problems, has become an end, a problem to be solved. We are no longer content to process data, we want to know if and how this machine can simulate our brain. And if it can't, how can it become the best amplifying prosthesis of our faculties? We already have anticipatory essays on this: the 'dumb' machine can be equipped with millions of sensors that send it minute, numerical and therefore perfectly computable data from the whole of society. Chaotic data (a bit like weather data), from which, however, it is possible to derive ordered patterns that will be

used to send 'instructions' to automatic or human actuators. The dumb machine thus becomes part of an intelligent system doing what it does best: processing data extremely fast, perhaps inspired by the pattern of brain activity:

> *"The new approach is based on the connectionist paradigm of the neural network, so called by analogy with the biological network of the brain composed of neurons connected by synapses. The old point of view, which claims to simulate and understand the functioning of our mind by drawing inspiration from the analysis of the sequential finite-state computer, is in a sense overturned: instead of tracing the comparison of our brain to the structure of the sequential computer, we start from the model we can make of our mind, with the knowledge we currently have, to build a machine with a neural network structure that emulates its behaviour" (Control systems, University of Brescia).*

This will happen when we have learned as a species to consider ourselves and be a large superorganism evolving in symbiosis with another superorganism, the Planet on which we live. This would not even have been imaginable if we had not projected ourselves (our own brains) into powerful data devouring machines capable of translating the chaotic agitation of social molecules and providing us with the output order of a society that knows what it wants and plans it.

The Advent of Symbiont Man

A result such as the conscious symbiosis between humanity and the planet will certainly not be achieved with obsolete forms of knowledge such as specialised disciplines and, above all, separated by the great dualistic barrier of matter/thought, science/humanism, technology/art. It is thanks to the evolutionary pressure exerted by the industrial revolution that the idea is now emerging that it will be science/technology, with its corollary of ever lighter and less energy-intensive machines, that will enable us to do without too many machines and too much technology.

In fact, a new form of intelligence is emerging, which has nothing to do with either human intelligence or that of today's computers. The von Neumann-style computer is powered by a language capable of interpreting reality through a series of yes and no (or true or false, etc.). Despite its little 'plasticity', this language allows us to model reality with great approximation and few errors even for drawing future scenarios. It is even incredible that with so few rules we can process so much, that with simple sequential procedures, a memory and a set of instructions we can simulate a flock of birds, a human society or a universe. But simply by changing the sequentiality by parallelization of processes, copying as well as we could what little we know of our own brain, we were able to simulate it to achieve quality-like results.

Neural networks are self-configuring as they process, precisely, in parallel, i.e. simultaneously. This means that the incoming data produce effects not only

on the outgoing data (which is obvious), but also on the system's way of processing, i.e. on the neural centres, which at this point modify themselves, alter existing connections, create new ones, and eliminate others. In practice, the neural networks self-learn as they process and provide responses. In this way, a continuously and spontaneously changing configuration is formed, which can be likened to a qualitative change. Information and structure influence each other. Whereas in a von neumannian machine learning must be programmed, in neural networks spontaneity, although dependent on the programme, is a qualitative leap, somewhat approaching the functioning of the biological brain.

The computer (neumannian or neural network), is a machine capable of simulating reality with a very narrow margin of error. Since Galileo, two foundations of knowledge have marked the history of scientific research: 1) the development of a theory from objective data and 2) the subsequent experimental verification. Computer simulation can be considered the third foundation.

Today, neural networks have lost some of their initial appeal and have disappointed the many who placed more trust in them than their evolution allowed. No other suitable discovery or technique has come to revitalise Artificial Intelligence research. Hundreds of thousands of industrial robots are at work in factories, but attention is captured by the ridiculous robot-dolls, machines with absurd human appearances that are not even useful for experimentation. Yet neural networks were promising ground, although, as always in capitalism, there was much propaganda over substance. The paradigm of which they were a vehicle was compatible with that of a society that knows itself to the point of completely overthrowing praxis and giving itself a project-based, anti-dissipative set-up. In order to bring our species into harmony with the energy coming from the Sun and participate in the transformations taking place in the biosphere, powerful machines and programmes capable of self-learning while managing dynamic patterns are indispensable. But capitalism just can't manage to develop a long-term (or even medium-term) discourse. Nor would it be able to do so even if a high rate of profit were guaranteed: every capitalist reasons in the short term, while genuine innovations, unlike those fuelling the new economy, require large investments and entail risks, so if the state does not take care of them, they are considered unattractive.

The “Famous” Reversal of Praxis

Agreed, 'reversal of praxis' is synonymous with the transition 'from the realm of necessity to that of freedom', or 'from prehistory to history' (for Marx, prehistory includes capitalism). Any project that alters nature to achieve a result desired in advance is reversal of praxis. The social pattern is well-known: levels of material determination lead to the party of revolution and, from that level,

determinations in the opposite direction go to influence society or neutralise attempts to return to the old defeated social form.

Wanting to show the different conceptions within the communist milieu, one could evoke the Gramscian phrase: 'Marxism is a philosophy of praxis' (actually it was coined by Antonio Labriola, but it was Gramsci who threw it in our way with the deleterious meaning it has today). Marx had no intention of founding a philosophy when he said that praxis is the organic man-nature reciprocation, and Labriola may have equivocated between the world and its interpretation, but in the Gramscian context the proposition is blatantly activist: the revolution 's'ha da fare'. Another famous proposition is: 'Marxism is not a dogma but a guide for action'. Attributed to Lenin who ascribed it to Engels, also popularised by Gramsci, it is a hotchpotch of nonsense: dogmas have been a guide for action for millennia and Marxism certainly contemplates axioms or principles that can be assimilated to the old dogmas. So what exactly does 'reversal of praxis' mean, a scientific formulation that has nothing to do with the messes we have mentioned?

The Universe is said to be made up of three quantifiable elements: matter, energy and information. The first two, which can be reduced to one according to Einstein's equation mass = energy, represent actual reality, about which we can measure physical quantities; the third is also measurable but, like mathematics, is not a physical quantity but... an invention of our own. As far as principles are concerned, therefore, there are currently some established ones, while others are liable to developments that are currently unimaginable. Physics, with the incompatible relativity and quantum theories, has reached a crossroads: since there is a clear incompatibility between them, they are certainly transitional theories. Theories of information and computation, too, seem to have reached a turning point. In the sphere of processing and computation, the Turing machine is the most powerful conceptual contraption in existence. How can we go any further if this very claim poses an insurmountable limit, when we know that such limits do not exist in science? Yet it is true: no essential change has taken place since Turing expressed the concept of universal computability.

It was only with some developments in quantum physics that theoretical experiments were attempted that led to the creation of computers based on new principles. Today, there are a few dozen of these experimental computers, but it is not yet known whether they work or not: compared with those with von Neumann architecture, they do not seem to have shown any noteworthy performance, so the Turing paradigm is not violated. The intuition that there is 'plenty of room' in the atomic world to experiment and operate dates back to the late 1950s, specifically to a report by physicist Richard Feynman, but the research and experiments in the field of computation are of recent years. The social limit is becoming more and more evident: in order to overturn practice, to be able to 'put the house in order' or 'glue the pieces of the cup', operations that

require a plan, one needs not only prior knowledge of what one wants to achieve, but of everything that is needed to achieve it. The plan is never just the design of the desired object, it is also and above all the path to get there. The knowledge implicit in the reversal of praxis is systemic, the end is everything, but only in the sense that the means are part of it. And this also applies to a revolution in our era.

But it is precisely in our era that the relationship between knowledge and realisation has jammed, that feedback that allowed us to co-evolve with our own products, material and social, to be able to learn from machines, once invented and used, even though we have so far managed to combine more disasters than wonders. As we have seen, science has become bogged down with the manifest incompatibility between theories of the macroscopic world (relativity) and theories of the microscopic world (quantum). Experiments are, of course, carried out and there are verifications to prove the reliability of the assumptions; in short, the theories 'work', but they produce very serious and heavy problems of knowledge. It may be possible to make a quantum computer work without knowing what exactly is going on inside it, as in the case of superposition of states or entanglement (particles that are waves at the same time; action at a distance independent of space and time), but certainly monolithic knowledge is not good ground for a quantum leap from Turing and von Neumann's machine to something more powerful. And since we make a revolution in knowledge dependent on a social revolution, until the social revolution explodes, there is little chance that a quantum computer will overcome its current limitations and pave the way for Artificial Intelligence with a capital letter, i.e. with the power to simulate natural intelligence.