Anti-Entropic Revolution

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"We are more solid in the science of the future than in the science of the past and of the present, all difficult, and all exposed to probability of the error, which no one will be able to say if it is more terrible the infinitely large or towards the infinitely small, towards the spatial abyss or towards the temporal one, which at the maximum distances, which today we dare to push the investigation, by surprise it jumps in front of him looks over your shoulder." ("Explorers of Tomorrow", 1952)

"The bourgeois demand that science is only possible within shackles of a constitutional limitation, the bourgeois attitude to grant her the function of (and yet with ever greater skepticism) the description of the past alone, respond to the claim that it does not exist a construction of the historical future of society is achievable, express the terror of Marxism and revolutionary prophecy." ("Relativity and Determinism", 1955)

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1. Introduction

The title of this work is taken from what was written in a chapter of *Science and Revolution*[1], our publication which was dedicated to the revolutionary development of capitalist productive forces and the Marxist theory of knowledge. In the chapter in question, entitled "Entropy and neg-entropy", communism is described as

> "the culmination of the anti-entropic revolution that began on three o'clock four billion years ago with the self-organization of the former protein molecules and resulted in today's complex vital system (which does not only include the human species)".

A scandalous statement for those who understand communism as a political ideology or as something that must be built with a will of great strength. Normally communism started with the publication of *the Communist Manifesto* in 1848, some backdate it to socialist utopias, those who push themselves to seek communist structures in Cistercian abbeys or heresies within the Church, those who set off all the way from pre-classist societies, where neither state nor property existed. But starting from the origin of life for most "communists" is way too much.

The vision of the revolution as a "total" one: physical, chemical, biological and, finally, social, is one of the characteristic traits of the current to which we refer, the "Italian" Communist Left, on whose work we base ours. Politically defeated current, but victorious in the theory of social becoming, given the innumerable scientific confirmations, and therefore a source from which to draw lessons for today and above all, for tomorrow.

How can we fail to remember, in this regard, what the representative of this current, Amadeo Bordiga, said at the Lyon Congress of the PCd'I in 1926:

> "You are only under the same political banner when you believe in the same conception of the Universe, of History and of Man's task in it."

Now with the theory of complexity, even the bourgeoisie is coming to understand that the dichotomy between the natural world and the human world does not exist feet, and that the organization of matter has invariant aspects a scale diversity.

History is not a slow gradual progression but, as the palaeontologist Stephen Jay Gould with the "theory of punctuated equilibria", long periods of stability are followed by phases of sudden change. This also applies to the revolution: there are long historical periods in which counterrevolution reigns materially and ideologically followed by sudden periods of social transformation.

There are references in the texts that are part of our political baggage to the great "historical arch" that holds together the fighting man with the beasts and the emancipated

[1] Quaderni di *n* +1, 1999

and joyful man of the future community.[2] Feeling part of this becoming, of this "going towards", means being aware that individual existence acquires only one meaning if it is related to other existences that preceded us and that they will happen to us. Adopt an '*On the Thread of Time'* conception (yesterday-today-tomorrow) of the revolution is essential to not exist sucked into the vortex of immediacy, which measures everything with a yardstick of daily success. Another legacy of the Italian Communist Left is the concept of "semi-finished": thanks to the organic progression of the work, with collective in-depth analysis, a result can always be achieved safer. To develop the theme we took up semi-finished products and correspondence produced around 2002, published on the QuinternaLab website with the provisional title *Del finalismo materialista*.

We started from these materials as the basis for a series of meetings, based on the classics of the Italian Communist Left and Communism, as well as a series of studies produced during the 20th century by what is in the Marxist context called "bourgeois science" *tout court*, but what else is it if not the state of knowledge reached by the species as a whole.

Although the present social form tries in every way to preserve itself, nothing can compared to the strength of the future human community (*gemeinwesen*), which is a real force acting on the present. A significant example of this is a movement like Occupy Wall Street, born in 2011 in New York, which in one of the writings published on its site declared itself to be an alien voice calling out against capitalism from the future. If an anti-capitalist movement with hitherto unheard-of characteristics has emerged in the United States: leaderless, organized in a network, anonymous, etc., it means that the revolution is underway and provides gods powerful essays of its existence. Recognizing them is equivalent to recognizing Communism.[3]

The capitalist mode of production, having conquered the whole planet, setting up factories and logistics networks everywhere, goes on disintegrating, and the effects are increasingly visible, so much so that even Economists with no knowledge of Marxism warn that catastrophe is near.[4] Being subject to the second law of thermodynamics (a continuous increase in disorder), it has a direction, the so-called "arrow of time".

But if capitalism tends towards heat death, towards thermodynamic equilibrium, to levelling, how is it possible to emerge from its ashes of a "phoenix", a new social form with higher energetic returns? By zooming in, and moving to a higher level of analysis, we can broaden the question: whether the most probable state in the universe is entropy (disorder), how was it possible for a state to establish itself less probable (order), life?

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[2] 'Considerations on the organic activity of the party when the general situation is historically unfavourable', *Il Programma Comunista* , n. 2, 1965.
[3] *Recognizing communism* (1958-59), Notebooks of *n* +1 from the Historical Archives. https://www.quinterna.org/pubblicazioni/storici/riconoscere.htm
[4] *The great catastrophe. Ten threats to our future and strategies to survive*, Nouriel Roubini.

The work we present attempts to answer these questions, which, naturally, also have implications with regard to conception of the class struggle and the role played by the revolutionary party which, as we will see, in the conception of the Italian Communist Left is considered an “anticipated potential” (a projection of the future onto the present).

2. The Final Cause

Philosophy and religion, with the advancement of knowledge having become sterile and reactionary branches, have for hundreds of years been tools to guide the activities of men. They have been a useful, positive product in the advancement of knowledge. The knowledge of the ancients should therefore not be treated with complacency but should be studied in the light of later scientific achievements. Let us therefore start from afar, from what the philosopher of Stagira, Aristotle, wrote in the *Physics*, a treatise of eight volumes, assembled after his death, and dating from around the 4th century BC.

A summa of knowledge at the time, a search for the principles and causes that move the universe, it is an example of humanity's labours and efforts to understand the workings of the world. In the Second Book of Physics, four underlying causes of change are identified:

- formal cause: consists in the form of an object;

- material cause: consists in the matter from which an object is made;

- efficient cause: it is the agent that brings about change;

- final cause: the most important, the purpose for which something is made.

But the four causes could be reduced to two: the efficient cause and the final cause. The first was not sufficient on its own to explain the evolution of natural phenomena, so it needed a fundamental addition, represented by the second, the end. Aristotle asks himself in the *Physics*:

> "But what, therefore, is the thing that comes into being? Certainly not that from which it is born, but that to which, in being born, it tends."

The insect that becomes larva, hence chrysalis, will be conditioned in the process of its becoming by its perfect form, which is that of the butterfly. Therefore, it is the final form, that which is realised, under favourable circumstances, at the end of the process of development, which influences the course of the process itself, which directs and guides it. For Aristotle, the final stage of the process acts as if drawing the organism towards itself. The final cause of the world is, as in a living organism or an instrument, its form. This final form, i.e. the potential and actual future that guides the past, the same future that in turn is inscribed in the efficient causes of the past, coincides with 'God' for Aristotle.

Although the concept of final cause is viewed with suspicion by modern science, and some biologists claim that the evolutionary revolution represented by Charles Darwin is to be understood as an abandonment of the Aristotelian biological tradition, biologist Ernst Mayr's thesis is instead that Aristotle's thought was largely correct, and the concept of final cause should be taken up and filtered through the theory of self-organisation, setting aside all mysticism and religion (thus including that of 'intelligent design').

Aristotelian examples of the future acting on the present are: 1) all constructions erected by man to inhabit them, built for the purpose of maximum stability, on stone foundations and with a roof of beams and earth; 2) the saw, an instrument intended for cutting and therefore consisting of a toothed iron blade. And so: if it is the end that guides the very choice of means for its realisation, can we not say that Aristotle is the first enunciator of what the Italian Communist Left calls the 'reversal of praxis'?

Regardless of the name 'God' attributed by the philosopher to the final cause, it is evident that his God has nothing to do with the figure of a 'propelling' entity, but is seen as the end of a tendency. Aristotelian results were later immobilised by medieval scholasticism and interpreted in a religious and spiritualist key, and finalism became anthropocentric.

3. The Future Society Acts on the Present One

After a few millennia, the question of the end that determines the means to reach it is still a subject for study and discussion in science and, as we shall see, has guided the research of various disciplines in the last century, from cybernetics to complex systems.

The theme of the future guiding action in the present has always been of primary importance, and it is no coincidence that the press organ of the International Communist Party after the Second World War was entitled Il Programma Comunista.

Programme means written beforehand, written provision of an operational plan. Programme is synonymous with project, which means realisation on paper or another medium of future work. If it is true that the work will be built according to plan, then it is the future work that moves the designer's hand. Let us think of a bridge: the engineer who designs it must imagine the work as if it were already built; in fact, models are produced or computer simulations are made of the structure to be built in the future.

Again according to the biologist Ernst Mayr (Biology and Evolution), we can say that in biology a programme is "encoded or preordained information that controls a process or behaviour leading it towards a given end." For nature, the existence of the future is a given, for the simple reason that reproduction (asexual or sexual) makes possible the formation of new organisms or the continuation of life on Earth. As biologist François Jacob explains in his book The Logic of the Living: *'In a living being, everything is organised with a view to reproduction.'*

Information is then what determines form, which is to say that the future form conveys the information necessary for its realisation. To argue this is to be a finalist? First of all, let us clarify the meaning of the expressions 'teleology' and 'finalism', which derive from the Greek word télose and the Latin word finis, respectively, which correspond to the Italian 'scopo', 'purpose'. Let us now see if the classics of communism can help us in framing such a complex subject.

For the Marx of the Economic-Philosophical Manuscripts of 1844, it is the possible communist future that guides "*the history of the preparation for man to become the object of sensitive consciousness and the need of man as man to become need. History itself is a real part of natural history, of nature becoming man. Natural science will later subsume the science of man under itself, in the same way that the science of man will subsume the science of nature: then there will be only one science*"

Based on these statements, it is argued in various quarters that the young Marx is guilty of finalism because he is still too influenced by Hegelian philosophy. We refer the reader to our article 'Marx: 1818-2018' (n+1, no. 44, December 2018), in which we dismantle such theories, pointing out that in the Manuscripts of 1844 Marx writes a long chapter in which he rejects Hegel's dialectic itself. Human history is an integral part of natural history, and there must therefore be unitary laws that explain the becoming of the whole of man-nature-industry.

It is certainly possible to discern a kind of finalism in Marx's thought, however, one must, as mentioned earlier, understand the meaning of the term, which is known for its use in philosophy and religion. The fact that some terms identify different things according to their use also applies to the word 'communism', which reminds some people of Stalinism, Maoism or the PCI. It is not easy to make our listeners understand that communism means a destructive dynamic of the existing and not a form of government, an ideology or the thought of some particularly intelligent leader.

Determinism is not foreign to the concept of the end, although the sense of our finalism is at the antipodes of what the bourgeois and petty-bourgeoisie who would like Marx and his school forced into a deadly embrace with idealism intend.

Years ago a reader wrote to us, introducing himself as a parish priest,[5] stating that he saw a kind of finalism in our work and asked: "Can it be said that a certain teleology is at work in your view of history?". We replied that we would have preferred another term, e.g. teleodynamics (from télos = purpose + dýnamis = force in potency, movement of bodies in relation to the causes that determine it) to define what 'our' current, from Marx to Bordiga, has expressed and which is to be understood not in a mystical but in a materialist sense. We refer to the passage in the German Ideology where '*communism is called the real movement that abolishes the present state of affairs*'. The historical movement is oriented

[5] Doppia direzione, *n*+1, n. 40 dicembre 2016.

towards an end, the communist society, and this is demonstrated by the unceasing development of the productive forces, which negates the present relations of production. Private appropriation of the product of other people's labour still exists, but this too, like labour, is being socialised, since instead of individual capitalists, who have become salaried functionaries, big capital is concentrated in anonymous, impersonal structures. The contradiction between social production and private appropriation is becoming increasingly explosive. Moreover, as Marx states in the Grundrisse, "if we could not already discern hidden in this society - such as it is - the material conditions of production and relations between men, corresponding to a classless society, every effort to blow it up would be quixotic."

Uncovering and highlighting what are the symptoms of future society is one of the tasks of n+1's work, which, like any other political work, has goals, is finalised. The term finalism is dense with ambiguity and confusion, it has a history that weighs like a boulder, it cannot be ignored, but this should not prevent us from taking what interests us from an author or a theory even if we do not accept it in toto. The historical party (programme) is the product of the heritage of knowledge formed over millennia of history and therefore incorporates the knowledge of those who came before us and brings it to a higher synthesis. To the accusation of Aristotelianism that might be levelled at us, we reply that we have no sympathy for 'isms', for doctrines named after an individual, no matter how important his thoughts and actions may be.

The Catholic Church used Aristotle's thought through Thomas Aquinas to demonstrate that faith and reason are not in conflict but complement each other. It was a grandiose operation of syncretism.

Of course, for the scholastics, the expression 'final cause' (sometimes used in the plural, 'final causes'), took on a general meaning and was used more to demonstrate the existence of God as the architect of the universe than anything else. Those scholars, however, were not obfuscated by a 'scientific' presumption, unlike the 'modern' approach: they recognised the need not to observe phenomena as due apriori to a divine plan, and were wary of voluntarily placing God in the mechanism of nature; but once the latter had been scrupulously observed with the instruments available at the time, how could one fail to recognise that everything is admirably arranged in an orderly and intelligent manner? How can we not believe in an intelligent cause above everything? If we question the world about itself, we are forced to believe that the world is self-proclaimed 'perfect'.

Finalism, over the centuries, has become anthropocentric, as demonstrated, for example, by the 'philosophical' thinking of John D. Barrow (astrophysicist) and Frank J. Tipler (physicist), authors of the book The Anthropic Principle, which has caused much debate. The two scientists argue for the existence of a cosmological principle whereby the universe was 'made' so that there would be someone to observe it and give awareness to it. Anthropocentric finalism holds that the world is the intentional work of some entity

capable of thinking, willing and realising its own will and is therefore constructed by it for a specific purpose. According to this school, all elements in nature exist because otherwise there could not have been man, the ultimate end of some creator's design. An argument in support of this thesis, which is decisive for them, is that the conditions that make organic life possible cannot be found everywhere in nature, conditions that we find on Earth instead.

The term 'teleodynamics' used appropriately in place of 'finalism' might help avoid the generation of ambiguity, but philosophers have devised a magic formula: accompany the term 'finalism' with an adjective: Catholic finalism? Asian finalism? proletarian finalism? hot finalism? or, as Marx mockingly put it, 'yellow as a logarithm'? For goodness sake, clarifying the processes of knowledge maturation through operations on language is permissible, but some boundaries cannot be crossed.

In some instances, for example in a few lectures, we have also done this and spoken of finalism in search more of an appropriate definition, an expedient, as if through the adjective one could arrive at information that was not debatable and interpretable.[6]

Biologists, in order not to incur accusations of religious finalism, instead of teleology, understood as the doctrine of final causes, use the term teleonomy to refer to the internal finalism within the structures of living organisms shaped by Darwinian natural selection. Analysing the cell, we realised that its formation is already contained in the genetic programme, which is precisely aimed at the development of the organism. Ernst Mayr argues in Biology and Evolution:

> "That there may be a programme underlying a certain phenomenon various sets of facts suggest this. If, for example, between two species of birds living together in the same region, one is migratory while the other is not, one is obliged to conclude that these species differ in their genetic predispositions, i.e. in their genetic programmes."

However, many biologists disagree with this conclusion, which they consider to be 'genetic-centric', and place their attention on epigenetics, i.e. the branch of science that studies heritable changes in the phenotype.

4. Finalism and its Fascets

In the philosophy of biology, a branch of the philosophy of science, we find on the one hand currents that adopt a religious and idealistic type of finalism, and on the other hand currents that adopt a mechanistic conception; according to the latter, all phenomena

[6] The approach of a little-known author today, D'Arcy W. Thompson (*Growth and form. The geometry of nature*), who lived in the first half of the 20th century, is very different. He hypothesizes a world system subject to pure determinations, such as that which influences the development of the jellyfish shape, shaped by gravity which acts on the mass differential between the molecules of the body and those of the liquid destined to act as its environment (the author illustrates his hypothesis with a drop of ink dropped into a glass of water). Thompson, studying the relationships between the shape and size of organisms, comes to the conclusion that they are determined by laws. The evolution of an organism is not free but is forced by the other forms and forces that act on it.

in the world can be summed up in mechanisms that are not directed by any end, and it is chance that is at the origin of all novelty. One of the representatives of this idealistic mechanism is the 1965 Nobel Prize winner for medicine, Jacques Monod, theorist of 'creative chance', and author of the famous essay Chance and Necessity, in which he argues for chance in mutations and the necessity of the laws of natural selection as the ultimate explanation of natural evolution[7]. An obvious oxymoron: "How can anything ever exist by chance and at the same time necessarily?"[8]

For Monod, natural selection acts on genetic mutations by eliminating unsuitable ones and favouring suitable ones, which are replicated from generation to generation according to inexorable determinations; any interpretation of biological phenomena in terms of final causes would therefore be wrong. Man's destiny is not already written, it is up to the (bourgeois) individual to build his future according to the skills and knowledge he has accumulated over a lifetime. This is pure existentialism, there is no historical dynamic, determinism is not valid, and by adopting it we return to 'transcendent' visions of history and nature. In reality, Monod's 'chance' is nothing more than an 'uncaused cause', a postulate, a new God to bow down before. Here, then, is transcendence let out the door and back in through the window. Naturally, such positions, developed in the academic sphere, also have repercussions in the political sphere. If science is not immune from the ideological influences of the bourgeoisie, neither is it immune from the ideological influences generated by pseudo-proletarian imbastardisation.

Communists are neither on one side (idealistic finalism) nor the other (casualistic mechanism), they are something else. They are proponents of determinism, i.e. the assumption of the bi-directionality of events, i.e. the reversibility of processes: what precedes is the cause of what follows, conversely what follows is the cause of what has gone before. Not being creationists, they believe in the capacity of matter to self-organise. As far as chaotic processes are concerned, when the factors at play are too many and too complex to allow an exact prediction, they use statistics and the calculation of probabilities, but certainly not to question determinism (if it is possible to make statistics, it means that there is an underlying order, a series of invariant elements such that coherent groups are possible).

The work of communists is determined by the continuous line of history, even if they individually see only a segment of it, that of their existence. On the other hand, those who adopt as their unit of measurement not the millenary programme of the species, but their own limited existence, thereby become existentialists, and place themselves ideologically and politically outside the revolutionary dynamic.[9]

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[7] The essay *Chance and Necessity* is criticized by *Program Communiste,* n. 58, 1973, in the article 'On Chance and Necessity. How Mr. Monod would destroy dialectics', in which the author is accused of *'biological anti-determinism'* and therefore of *'general anti-determinism'* .
[8] Foreword by Pier Paolo Di Fiore to *DNA A code for writing life and deciphering cancer* .
[9] 'Existentialism', *Prometheus* n. 11, November-December 1948

The 'great bridge' between the Australopithecus and the sapiens that in the 1965 Considerations on the Organic Activity of the Party was not only desirable but soon to be realisable, functional, unifying, didactic, in a powerful anticipatory image, was to be the result not only of the organisation of matter but also of the party. This entity would develop and provide the programme that the class struggle would endow with a driving force.

Once the process of polarization has been triggered that unites the forces bent on the destruction of this society, the collective action of the communists is determined by the end they 'want' to achieve, which is the new classless and stateless society, organised rationally according to a plan of sorts. To get there, the path is already mapped out, otherwise we would be creating new categories out of nothing, and the materialist conception of history does not allow this. The future determines the past and wipes out those who 'wrong' the path, taking paths, usually illusory shortcuts, that lead elsewhere.

What acts in praxis is the represented purpose (Marx, Manifesto: communists represent the future of the movement at all times...) and for the individual, representation or determination is confused in his brain with desire. History does not care, even single, generalised and oriented desire is a determination towards the goal.

5. A Little History of Determinism

The fate of the ancients was an aspect of extreme determinism, both in the form of astrology, probably the oldest, and in its religious form. Either way, it is a belief that every event is strictly predetermined by an 'external' entity (stars, gods, etc.) more powerful than any will.

In ancient Greek philosophy, a mechanistic type of determinism takes shape in the thought of Leucippus and Democritus. For Democritus, "*from infinite time all absolutely all things past present and future are governed by necessity.*" With the advent of monotheistic religions, everything is traced back to a God; it is this entity that determines events. It is with the Renaissance that a true technical-scientific revolution takes hold, driven by the social productive force, which tends to deny the use of supernatural forces to explain the workings of nature, even though magic, alchemy and astrology still have a hold among scientists.

But it is with Galileo Galilei that science takes a leap forward. Determinism in Galileo (or rather determination) is not yet in the full sense, but it is the recognition that every fact has determinate causes: the distance between two points is 'determined' by drawing a straight line; the opposition of celestial bodies determines an eclipse, the increase of a mechanical mass determines an increasing weakness of its structures.

Determinism after the Greeks and before Laplace has a concrete meaning that reaches its highest level of expressiveness with Galileo: the man of science will be able to

gain the greatest knowledge of natural phenomena to the extent that he will be able to recognise experimentally what produces them and then treat them mathematically.

With the approach of the bourgeois revolution, the detection of facts and the derived theory are enriched with powerful abstractions: determinism becomes a universal order whereby each fragment of reality depends on preceding fragments in a given concatenation that is predictable in principle.

This new vision of the world emerges from Diderot and D'Alembert's Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers, the summa of the knowledge of the time, the manifesto of the revolutionary bourgeoisie, interested more in practical knowledge than in transcendent knowledge, more in the results of industry than in empty philosophizing.

If statistics of apparently incongruous facts are possible, it is because a determinism operates that allows them to be treated in large groups. The 'strong' interpretation of this theoretical position is that of Laplace: every event in the Universe is closely interconnected so that every state of a system observed at a given time corresponds to one state and one state only at an earlier or later time.

The term 'determinism' was introduced at the beginning of the 19th century, and in the philosophical and scientific language, it completely undermined what would come to be called 'fatalism', now with a derogatory meaning (the same fate would happen later, with much less reason, to Newton's mechanics, which would become 'mechanics'). The enemies of determinism will allude to its alleged lack of elasticity by comparing it to fatalism, but this version will not hold up for long, if only because Leibniz had already nipped in the bud any attempt to belittle determinism: the discovery of the existence of the link between causes and effects should destroy any fatalist hypothesis.

Having established that there is clear and demonstrable determination from the past to the present, we deduce that the same determination acts from the present to the future, even though we are often unable to predict what will actually happen, especially in complex systems. The logic of determinism is not invalidated by our inability to use it for our predictions.

6. Last Phase of Prehistory

Asserting the existence of the future is the dividing line between determinists and indeterminists. Supporters of indeterminism have been and are many, especially among philosophers, such as Popper and Bergson in the past. The latter, for example, argued that at the basis of life, there is a vital impulse (élan vital), something creative. If we can understand the rationale behind his theorisations in the face of the knowledge of the time (the 19th century) regarding the evolution and growth of order in nature, we cannot justify their revival during the 20th century by certain currents, including the anarchist currents, in

particular by the revolutionary syndicalists and the component that would lead to fascism.[10] To argue that from a theoretical point of view, a future may not be the product of a past is to argue that between a point in the past and a point in the future, there is a creation.

Revolution is not a complex of actions dependent on some organisation or group, let alone some genius leader, it is to be understood as a material process that manifests itself when a certain threshold is crossed in society. It gives tasks to men, not receives them. The ecological crisis, the generalisation of war, growing misery, and the economic problems that disrupt the present social form generate growing unease in all classes, but this does not automatically translate into a revolutionary drive. There is no mechanical connection between the collapse of capitalism and revolution, as explained in the article 'Activism[11]':

> "It may happen, as is the case today, that the bourgeois economic and social world is shaken by formidable shocks, which give rise to violent confrontations, without the revolutionary party having the opportunity to magnify its activity, without the masses thrown into the most atrocious exploitation and fratricidal slaughter being able to unmask the opportunist agents who bind their fates to the contentions of imperialism, without the counter-revolution loosening its iron grip on the dominated class, on the masses of the dispossessed. "

Material determinations cannot be escaped, it is not the class party that must chase the masses, but it is these that will be driven by powerful material facts to tune in to the revolutionary programme. Loosening our grip on this assumption can cause immense damage, as the history of the three Internationals proves. In a situation like the present, the consignment is therefore to defend the continuity of the communist programme. Which means, preserving, studying and elaborating the historical heritage bequeathed to us by the Italian Communist Left in order to pass it on to new generations.

If a set of phenomena is predictable, it means it is finalised. If we say that the dynamics of capitalism are predictable, it is because we have identified internal laws that decree its end. If we show that the goal of capitalism is not the enjoyment of the capitalist but the accumulation of more and more capital, we also show the non-necessity of capitalists and their mode of production. With the bourgeois revolution, the consequent establishment of the new mode of production represented a great historical leap having developed associated labour on a planetary scale; once this task is completed, its function becomes exclusively reactionary.

Marx and Engels' beautiful image of capitalism as the last stage of prehistory, and communism as the beginning of history, is based on the clear separation of the socio-economic systems and at the same time on the continuity of the species. True knowledge will come after the revolution but will be anticipated in the party. For Marx,

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[10] 'Bergson's pioneer', Il *Comunista* , 26 June 1921.
[11] *Battaglia comunista*, n. 6 e 7, 1952.

'*communism is the solution to the enigma of history, and is aware that it is this solution*'.[12] Communists do not merely describe the present but outline the characteristics of the future, and from this they draw lessons for action in the present.

Starting from these theoretical premises on the teleological principle, we will analyse in the next chapters some scientific works developed during the 20th century around the concept of negentropy (or negative entropy). If the concept of entropy is commonly accepted and understood, its opposite is less so; yet there is not only chaos in nature but a superabundance of order is visible all around us.

7. Anticipated Potentials

The 20th century was a century full of fundamental events in all respects. It was the century in which for the first time the proletariat seized power and the event took on a global dimension. Scientific theories were born and developed as the product of a revolution that matured tumultuously in the depths of society.

The development of the productive forces gives a propulsive thrust to scientific research, which backfires, causing industry to leap forward. That twofold revolution best represented by Einstein's relativity and quantum theory (both of which will fail to integrate) explodes. Einstein with his theory of special relativity disrupts the abstract concepts of time and space, merges them into a single reality (space-time) and establishes a new scientific paradigm. According to Einstein, the universe explains itself by the means it has: energy = mass x speed of light. There is no longer an absolute time, the same everywhere, since time flows more slowly close to a mass. Therefore, there is no guarantee that in a given reference system the cause does not come after the effect.

The notion of traditional, absolute time is useful for organising everyday life; but when we take into account the distances between the Sun and the other planets in our solar system, or between our galaxy and the other galaxies, it no longer works (space modifies time and vice versa), so much so that the very idea of a single present for everyone is lost.

One scientist fascinated by Einstein's work is Luigi Fantappiè (1901-1956), an important mathematician of the Italian school[13] (National Institute of High Mathematics at the University of Rome). With his work, he was a proponent of countercultural theses, such as that memory functions by means of non-local processes in space-time (the human mind can connect to past and future events present in the space-time continuum).[14]

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[12] K. Marx, *Economic-Philosophical Manuscripts of 1844* .
[13] 'Teoria degli Universi e Sintropia. Luigi Fantappié, ricordo di un matematico', Ignazio Licata: https://www.altrogiornale.org/teoria-degli-universi-e-sintropia-luigi-fantappia-ricordo-di-un-matematico/
[14] Eccentric idea but one which recalls some statements that were supported by the Italian Communist Left for example in the *Dialogue with the dead* : *'It is the Revolution that is one; and it is always her, in the course of an immense historical arc that will close as it opened and where it promised; where it has an appointment perhaps with many of the living, but certainly with the unborn, as with the dead:*

We are interested in Fantappiè for the theory of 'anticipated potentials', which describes waves converging towards a source located in the future. The Italian mathematician's thesis was considered erroneous by some mathematicians contemporary with him, such as Francesco Severi, according to whom finalism is an act of faith, not an act of science. Fantappié is a Catholic, he makes no secret of this, and directs his work towards demonstrating the existence of God: he is keen to show that the laws of nature themselves correspond with the laws of love found in the sacred texts of the major religions. But we are interested in the scientific results he arrives at. Bearing in mind that there are materialists capable of saying metaphysical nonsense and metaphysicians capable of saying interesting materialistic things.

In his work, which we will not address from a mathematical point of view, he argues that just as entropic systems exist, so do negentropic phenomena, which he calls syntropic, in which the effect shows itself before the cause.

For Fantappié, biological phenomena cannot be reproduced in the laboratory since their cause lies in the future, but he argues that even without being able to formulate a law, it is clear that there is a series of phenomena in which a principle based on final causes is evident (and this in itself makes the hypothesis of reverse determinism in time rational).

If we want to give an easily understandable example of the two phenomena, entropiy and negentropiy, we can imagine a stone being thrown into a pond. The cause is us throwing the object into the pond, and when it touches the liquid it generates a series of diverging waves, which are the effects. This is an entropic phenomenon. If, on the other hand, we think of a syntropic phenomenon, we have to imagine a calm pond, a rippling of the water, the formation of waves converging towards a point and finally a stone emerging from the pond and coming towards us. This is a phenomenon that is not theoretically impossible but highly improbable, as if a building collapsed with dynamite would be reconstituted as it was before the explosion.

To take another example, think of a neat deck of playing cards that is shuffled. Now, the chance of regaining the initial order by continuing to shuffle the cards is small indeed, but not impossible:

> "The improbability of heat passing from a colder to a warmer body (without help from somewhere else) is identical to the improbability of order creating itself from disorder (without help from somewhere else). Both, fundamentally, are only due to statistics. Counting all the possible ways in which a system can be arranged, the disordered ones outnumber, and by far, the ordered ones." (James Gleick, The Information)

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these knew that it never fails, never deceives. In the light of doctrine, it is already taken for granted as a thing seen, a living thing.' (*Il Programma Comunista* No. 5 - 10, 1956).

The second principle of thermodynamics is statistical, not mechanical. Although thermal death is the most probable state in the universe, there are phenomena in nature that negate it, beginning with embryo development and chlorophyll synthesis. Life is a phenomenon that denies entropy, it proceeds towards higher levels of organisation, defying the surrounding disorder. And since organic matter and inorganic matter are composed of the same particles, there must be some law that explains self-organisation, or 'free order', as biologist Stuart Kauffman calls it. Matter is a collection of energy organised in some way within dynamic configurations called particles, atoms, molecules, and then cells and organisms.

Physical phenomena, like biological phenomena, manifest negentropic characteristics, i.e. local reduction of entropy (order) and increase somewhere else of entropy (disorder). One of the most astonishing examples of negentropic phenomena are the Giant's Causeway in Northern Ireland, known in Italy as the Selciato del Gigante, a rocky outcrop of volcanic origin composed of several tens of thousands of basalt columns with a hexagonal base. Past generations, unable to rationally explain the origin of these peculiar geometric shapes, thought it was the work of a giant who, armed with a pickaxe, had built a pavement to walk to Scotland.

The physicist Mark Buchanan with his important work around complexity science has identified self-organisation as a principle that explains the existence of invariances in various phenomena, physical, biological and social. We have reviewed almost all of his works, starting with the most interesting one for us, The Social Atom, in which he writes:

> "In recent decades, scientists and engineers have discovered similar 'self-organising' processes in thousands of fields: in biochemistry, where they create stripes on the backs of tigers or on the wings of butterflies; in the waves of the sea; in the sand dunes of the desert; in the great structures of cyclonic winds in hurricanes. The essence of self-organisation lies in the fact that a structure, a ring of stones or the precise distribution of atoms in a crystal, emerges of its own accord and in a way that has little or nothing to do with the specific properties of its component parts. No study of the earth or the Spitsbergen stones could ever explain those perfectly circular structures, just as no study of air molecules could in itself help to understand hurricanes. An explanation requires thinking in terms of structure, organisation and form, not atoms or microscopic particles of any kind. And what about human beings? It is evident, or should be, that we are probably subject to the same kinds of processes of collective organisation."

By working in this direction, in search of a unitary law that explains the functioning of nature in its various manifestations (including man), researchers like Buchanan make themselves instruments of the future society, in which physics, biology and sociology will be subsumed into a single science.

8. The Party as an Anticipation of the Future

Returning to the work of the Italian Communist Left, it made similar remarks to Fantappiè regarding the existence of 'anticipated potentials' (an acquaintance with the works of the Italian mathematician cannot be ruled out).

Within the present mode of production there is a tendency towards disorder (capitalism) and another towards order (communism). We have seen that the private appropriation of the product of labour coexists with the socialisation of labour. However, this contradictory dynamic cannot hold for long and one of them will take over, it is already happening.

But in order for 'order' to be imposed, it is indispensable that a revolutionary organism matures to provide direction. In the Theses of Naples[15] it is said that if today the party is a political organ in struggle with other parties, tomorrow, having overcome capitalism, it will be an organism that '*carries out the defence of the human species against the dangers of physical nature and its evolutionary and probably catastrophic processes*'. Tomorrow it will therefore lose its political envelope, which is necessary in a class society such as capitalism, and it will no longer even be understood as a 'partito', a word derived from 'parte'. It will die as an organism of a class with political tasks, but will persist as an instrument in the service of organic species activity.

To demonstrate that this view of the species-party community is characteristic of the current we refer to, we quote a series of quotations from the party press:

> - In the last chapter of Property and Capital[16], "*Utopia, Science, Action*": "*Everyone who forms and possesses plans works on data of the future.*"
>
> - *In Doctrine of modes of production[17]:* "*Let us define the party: projection into today's Man - Society of tomorrow.*"
>
> - In Origin and Function of the Party Form[18]: "*The party realises the anticipation of the social brain.*"
>
> - In Party and class action[19]: "*In order to give a precise, and let us say almost tangible, idea of the 'technical' necessity of the party, it would perhaps be advisable, if the exposition were to take an illogical aspect, to consider first the work to be done by the proletariat after coming to power, after wresting from the bourgeoisie the direction of the social machine.*"

[15] *Il programma comunista*, n. 14, 28 July 1965.
[16] *Prometeo*, n. 10–14, 1948/50.
[17] *Il programma comunista*, n. 3–4–5–6, 1958.
[18] I programma comunista, n. 13 from 1961.
[19] Rassegna Comunista, n. 4, 31 May 1921.

To understand the party's tasks in today's world, one must project oneself into the future society. This may appear illogical to most, but for communists - 'explorers into tomorrow' - it makes perfect sense: adopting the political categories of the present society (leaderism, careerism, individualism, etc.) would reproduce what one wants to deny. The logic of revolution is circular: the means must be appropriate to the end to be achieved.[20]

In the Theses on the Tactics of the CPd'I[21] referring to the function of the communist party, the drafters speak of "unified activity inspired by the highest revolutionary aims" and the achievement of "*objectives that exceed the interests of individual groups and the immediate and contingent postulates that the working class can set itself*." It is as if to say that the future designs in the present the material elements of its own realisation. Strategy and tactics are thus subordinate to the goal to be achieved, they cannot be changed at will. To grasp these countercultural concepts, it is not enough to have a cultural background or even scientific demonstration, one needs faith, struggle, passion for communism, and this is not created, it is a reflection of the productive forces pressing to free themselves from capitalist chains.

In a correspondence with some comrades, Bordiga pointed out that workers are not 'cheated' by the little culture but by the one they absorb too much of at the bourgeoisie's school:

> "You have no practice of intellectuals and you don't know enough how empty cowardly fools they are and how difficult they are to move an inch from the dominant prejudices. For forty years I have learned the hard way how much more easily a working-class audience grasps daring theses that are radical and counter to traditional ideas, whereas the well-meaning people, perhaps with several degrees, respond by enunciating gigantic and pitiful nonsense." (Bordiga to Salvador, Naples, 23 November 1952)

9. The Discovery of Neg-Entropy

Productive forces develop and determine the formation of new production relations, new social relations, and new worldviews. The 20th century, among other things, was the century of the invention of the computer. The first electronic calculators were huge and consumed an inordinate amount of energy; today they fit in a trouser pocket, consume much less and are more powerful. The miniaturisation of technological devices entails, as the writer Italo Calvino would say, the transition from heaviness to lightness (American Lessons). This process of 'technological shrinkage' is an example of information reducing entropy.

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[20] *"When communist workers gather, they initially have doctrine, propaganda, etc. as their aim. But with this they jointly appropriate a new need, the need for society, and what seemed like a means has become the goal"* (K. Marx, Economic-Philosophical Manuscripts *of 1844*)

[21] *Rassegna Comunista*, anno II, n. 17, 30 gennaio 1922.

We can define as information anything that is capable of reducing the entropy of a system. Ludwig von Bertalanffy, who introduced systems theory into biology, defined information as an anti-entropy factor.

The physicist Léon Brillouin, the one who discovered a particular type of scattering effect (scattering that underlies the functioning of fibre-optic systems), was also interested in negentropy, arguing that each unit of information present in a system corresponds to a decrease in entropy: the larger the information, the smaller the entropy. Shifting his analysis from the physical to the biological field, Brillouin noted that organisms have the capacity to repair themselves, to reconstitute an order that has been lost:

> "The living organism heals its wounds, cures its diseases, and can rebuild large portions of its structure when they have been destroyed by some accident. This is the most unexpected and most striking behaviour." (Life, Thermodynamics, and Cybernetics, Harvard University)

Living processes are not governed solely by the second principle of thermodynamics, they do not exclusively manifest a tendency towards disorder, on the contrary, they evolve over time, acquiring order and information, and are therefore oriented towards an end, call it what you will. Olivier Costa de Beauregard, a French physicist and pupil of the great physicist Louis de Broglie, also observes the existence of 'retrocausality' in nature, i.e. information coming from the future. Astronomer Fred Hoyle (The Intelligent Universe) wonders where the information encoded by DNA comes from and answers that it can only come from the future: as living beings grow, they acquire information instead of losing it.

If unequivocal conclusions are reached from various parts of the scientific world on the interpretation of the laws of nature, it does not mean that the bourgeoisie has come to assimilate them as the expression of an ongoing revolution, but that the whole of mankind has. In the course of a few decades between the 19th and 20th centuries, our knowledge of the world was repeatedly disrupted by the introduction of new methods, concepts and theories. For example, information theory (Shannon) and cybernetics (Wiener) are intimately connected with each other and with other theories that presuppose them or are a consequence of them.

In the essay Energy and Civilisation. A History, author Vaclav Smil describes the convergence of studies and research over the last century on negentropy, noting that while in all closed systems there is an increase in entropy, living organisms, which are open systems, slow down thermal death by maintaining a constant flow of energy and information with the environment:

> "As long as they remain alive, these systems cannot be in a state of chemical and thermodynamic equilibrium (Prigogine 1947, 1961; von Bertalanffy 1968; Haynie 2001). Their negentropy (the process of growth, renewal and evolution) is associated with greater heterogeneity as well as increasing structural and systemic complexity. As with so many

> other scientific innovations, a comprehensive understanding of these realities only came about during the 19th century, when the rapidly transforming disciplines of physics, chemistry and biology identified common ground in the study of energy transformations (Atwater and Langworthy 1897; Cardwell 1971; Lindsay 1975; Muller 2007; Oliveira 2014; Varvoglis 2014)."

In nature, situations and events follow one another according to a dynamic that can be investigated using the criteria of the continuum: there is no void between the objects that can be observed; but each individual state or event can be studied as a discrete element, i.e. numerable. In this way, it is possible to use tools that give us further possibilities of knowledge. For example, it is possible to know a dynamic system by taking into account its frequency over time. Thus, according to the perception of a human observer, it is possible to establish the probability of an event occurring or not occurring in the presence of certain conditions. Overall, ordered systems and their subsystems are among the least likely, disordered systems are among the most likely. A designed system allows for the sequences imposed on nature to achieve a desired outcome.

In the social field we are the advocates of the theory of the 'least probable' realised with 'certainty' through the party organ. The contradiction is only apparent, it just depends on a certain use of language.

We of the homo species are also the certain product of less probable events. Living beings organise their lives and surroundings, and to do this they develop skills and abilities. It is now clear that more information = less dissipation. Data from the past serves the present to plan the future, but data from the future are just as important.

Major epistemological revolutions took place in the life sciences during the 20th century.

People wondered how life originated, how it evolved, and came to identify, in the early 1950s, DNA, the replication programme of life, the famous double helix, and this discovery went hand in hand with the development of information theory. But it is also understood that before the appearance of the genetic code, there must have been ordered structures. The second principle of thermodynamics does not help in this respect. One must then think not of entropy but, on the contrary, of information.

Biologist Richard Dawkins states in his essay The Blind Watchmaker:

> "At the heart of every living thing is not fire, not hot breath, not a 'spark of life', but information, words, instructions. If one wants a metaphor, one should not think of fires and sparks and breath. Think, instead, of a billion discrete, digital characters engraved in crystal tablets."

It is correct to focus attention on information against any vitalistic and metaphysical hypothesis of life, but in order not to fall into a genetic reductionism that, starting from DNA, wantins to explain the whole complexity of living things, it is useful to take up what the chemist Pier Luigi Luisi, proponent of a systemic thought, says: "*Life cannot be ascribed to any single molecular component (not even DNA or RNA!) but only to the metabolic network considered in its totality.*"[22]

The physicist Erwin Schrödinger, best known for his studies on quantum mechanics (in particular the equation that bears his name), was also interested in biology, and wrote a fundamental essay entitled What is Life? (1944). The answer he gives is as follows: although we have not yet identified it, there must be an anti-entropic principle that explains the strange phenomenon that is life, which feeds on negentropy, i.e. ordered material. To produce and reproduce itself, an organism must receive energy from outside. In the case of animals it is extracted from food through the metabolic process, in the case of plants it is extracted through photosynthesis. The planet is able to capture negative entropy from the universe by generating ordered systems. Quoting him:

> "How can we express in terms of statistical theory the marvellous faculty of a living organism by which it delays reaching thermodynamic equilibrium (death)? We have said [...]: the organism feeds on negative entropy, attracting a flow of negative entropy to itself to compensate for the increase in entropy it produces by living, by which it manages to maintain itself at a remarkably low level of stationary entropy."

The organism takes order in from its surroundings and expels the disorder it produces, with waste, i.e. 'degraded matter; not entirely degraded, however, since plants can still make use of it'.

So how do we define a living system? For Schrödinger:

> "When it goes 'doing something', it moves, exchanges material with the environment and so on, and this for a much longer period of time than we would expect in similar circumstances from a piece of inanimate matter."

The study of closed and open systems is therefore in the air, as witnessed by the work of Hermann Haken, professor of theoretical physics at the University of Stuttgart, who, while working on non-linear optics and laser physics, founded a new discipline in the 1970s, synergetics, which is based on the concepts of 'ordering' and 'enslaved': in any system, be it a laser or a company, the various parts are ordered by the synchronous movement of the individual enslaved elements. Thanks to a constant source of energy, a system can give itself more and more order.

Returning to our masters, even Engels was not entirely convinced that the first and second principles of thermodynamics were sufficient to explain the workings of nature (cf.

[22] Cit. in *The Science of Life* , F. Capra

Dialectics of Nature). He would probably have been very pleased to see that there were later developments confirming the accuracy of his criticism: the universe is not only able to maintain energy and information, as he claimed against the theory of irreversible dissipation, but is also able to produce information and thus make dissipation reversible. In contrast to some of the scientists of his time and in synchrony with ancient philosophers, for Engels the total energy of the universe remains constant. This statement, which is not in itself wrong, must however be supplemented with the knowledge available today about closed or open systems.

If the universe was generated by a singularity, by the Big Bang (as the standard cosmological theory states), and a highly ordered initial state lost order later, how did the initial order originate? Was an inverse, negentropic arrow of time operating before the Big Bang? Must the clock of the universe, in order to function, first have been wound up?

Physicist Roger Penrose attempts to answer this set of questions. Reviewing his studies on the Big Bang, he proposes a 'conformal cyclic cosmology', which consists of the idea that a phase of expansion (high entropy) of the universe will be followed by a new phase of concentration (low entropy). There would thus be a cyclic universe, consisting of a succession of phases, which Penrose calls 'aeons'. This theory was challenged in the book Matter: The Magnificent Illusion by physicist Guido Tonelli, who states that since the existence of mysterious dark energy has been discovered,[23] in our future there would be no great contraction, and the universe would proceed towards rarefaction: from the void we have come and to the void we shall return.

Today's cosmological theories do indeed have some problems. Not so much the question of their theoretical validity as the fact that they currently coexist without proving their falsifiability against each other. What really happened at "T = zero?" Scientists have not yet told us what the nature of the Universe object was in its first 3.5 minutes of existence.

10. Elements of a Unitary Theory of the Physical and Biological World

Luigi Fantappiè, whom we have already mentioned, developed a 'unitary theory of the physical and biological world' in the early 1940s, introducing the concept of syntropy or order as opposed to entropy, based on Einstein's studies on relativity and d'Alembert's equation describing the propagation of waves from a source.

This equation can be solved by going forwards or backwards in time, since there is total symmetry. We therefore have the solution of 'retarded potentials', which describes diverging waves from a source (us throwing the stone into the pond), and the solution of 'anticipated potentials', which describes converging waves (the stone leaving the pond and

[23] In the universe there would be dark matter, which tends to make it shrink due to gravity, and an equally mysterious dark energy, which instead tends to make it expand.

heading towards us). In the first case, the delay in the potential is due to the time it took for the propagation speed to travel the distance from the position where the source was. In the second case, the phenomenon occurs some time in advance of the source.

Negative entropy was also dealt with by Paul Dirac, Nobel Prize winner for physics, who in 1928 discovered the positron, i.e. the antiparticle of the electron, and began research into the inversion of the arrow of time at the subatomic level. In 1940, the physicists Richard Feynman and John Archibald Wheeler developed a quantum theory of electromagnetic radiation (absorber-emitter theory) in which symmetry with respect to time inversion is established. Fantappiè bases his research on this body of work with the aim of demonstrating the existence of sources located in the future that act on the present. For him, syntropy is synonymous with purpose, differentiation, order and organisation, the most appropriate words to describe the complex phenomenon we call life.

For Fantappiè, therefore, the essence of life is the principle of finality, and since life arises from non-life, he seeks to formulate a unitary theory encompassing inanimate and animate objects. The instrument for arriving at this result is physics, and he resorts to the mathematician Hermann Minkowski's space-time, a four-dimensional structure (the three spatial coordinates plus time), also known as the chronotope, to represent anticipated and delayed potentials.

In such a model, which we demonstrate below, the lower part of the cone of light, the past, contains all the configurations of events that prepared the upper part, just as the future contains the past that determined it. If for every point-event in the line of the universe travelled by a body in space-time we imagine a cone of light, we have the body's trajectory. Of course, the event is our abstraction, a discretisation of something that is continuous.

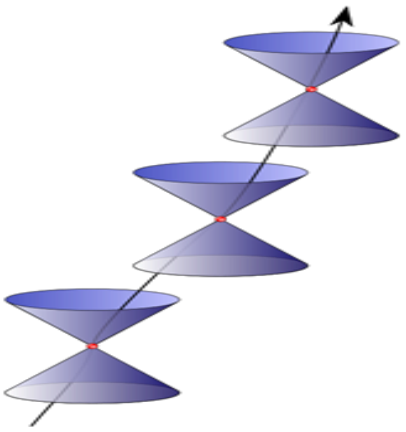


Figure 1. The world line traversed by a body in Minkowski spacetime (Author: Wikimedia Commons contributors)

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If for Minkowski the present state is the effect of the previous states and the cause of the following ones, Fantappiè adds to this geometric model the 'inversion of time',

whereby the two cones represent in space-time respectively diverging waves from a cause and converging waves from an end.

This is a 'blocked' view of space-time, in which all events have already happened, and in which past, present and future coexist. En passant: Einstein also claimed that the distinction between past, present and future is only an illusion.

A convergent wave symmetrically generates a divergent wave, but the two phenomena remain independent and separate; we have seen that for Fantappiè the syntropic ones are experimentally irreproducible because their sources are located in the future. This does not detract, the mathematician states, from the fact that syntropic phenomena are observable in living systems where there is a clear tendency towards the realisation of complex and co-operating structures tending towards an end.

In Principles of a Unitary Theory of the Physical and Biological World (Chap. II, 'The World of Syntropic Phenomena and Life'), he writes:

> "All living beings present a very marked tendency to concentrate ever new quantities of matter (and energy) in their bodies, a tendency that is expressed by the so-called functions of nutrition, and even more, for the fundamental elements that make up the living being (cells), of assimilation. This tendency toward concentration is visible above all in plants, with the continuous growth of both matter and energy (chemical, potential), due to the chlorophyll process, by which both the assimilated substances (carbon dioxide, water, etc.) and the radiant (solar) energy are processed and absorbed."

For Fantappiè, the sum of all the vital phenomena that take place on the earth's surface are more than just the sum of their parts and generate an immense organism, which can be called the 'biosphere'. The different species that populate the planet are to be considered as cells and organs of one large body. In his theory, which is presented as unitary, there is, however, a re-proposition of dualism, which his pupils Giuseppe (physicist) and Salvatore (chemist) Arcidiacono intended to perfect.

In 1957, the Arcidiacono brothers elaborated their own unitary theory, arguing that entropic phenomena should no longer be understood separately from syntropic phenomena, because every phenomenon, whether physical or biological, has within it two connected and indissoluble components, and they wrote:

> "According to Fantappiè, the development of an embryo, protein synthesis and chlorophyll photosynthesis are all 'syntropic' phenomena. But these only partially fulfil the characteristics of syntropic phenomena: in fact, in the development of an embryo we observe the process of differentiation, but there is also a degradation of energy; furthermore, it has been possible to realise the artificial synthesis of many proteins and photosynthesis in

the laboratory, in stark contrast to the principle of irreproducibility, which is valid for syntropic phenomena."[24]

In some phenomena the entropic component prevails, in others the syntropic component. But there are equilibrium phenomena in which the two components neutralise each other. In a living organism, in youth, the syntropic phase is predominant, in maturity there is an equilibrium phase between the two polarities, in old age there is a prevalence of the entropic component, which will eventually prevail. In the study of entropic phenomena it is the experimentation phase that prevails over the observation phase, the opposite is true for syntropic phenomena. The living is a circular system, which produces itself, implying the existence of both causality and finality. For Archdeacon the phenomenon we call life is an interaction between causes placed in the past and causes placed in the future, entropic and syntropic phenomena merge together. Examples in nature are countless: solution and crystallisation, respiration and photosynthesis, anabolic and catabolic phases of metabolism, etc.

Even the capitalist mode of production, we observe, can be analysed using this key. At any stretch in the history of a complex system, especially a biological one, the graphs of the phases of global development appear as cusps (zero to max). With reference to well-established doctrines: systems theory, catastrophe theory, auxology (laws of the growth of organisms) we can trace within the said global system three sub-phases: 1 - birth and development (maximum of syntropy); 2 - maturity (equilibrium, homeostasis); 3 - senescence (maximum of entropy). Finally leading to the thermal death of the system.

It is as if within itself, capitalism is fighting a struggle between the pushes that come from the past and those that come from the future. A struggle between the anarchic need to accumulate more and more surplus value (positive feedback, growth) and the rational need to balance itself by distributing value in society (negative feedback, homeostasis). This struggle will be won by the anarchist component of capitalism because this mode of production is incapable of forming a one-world government that can 'put things in order', even though it has put in place structures formally designed for the purpose. This is not due to the ineptitude of the capitalists or the rulers of the day, but to its mode of being, which responds to the mechanisms of profit, i.e. the one-sided M-C-M' dynamic.[25] The causes antagonistic to the fall in the profit rate, which slow down the historical crisis of senile capitalism, at some point turn into their opposite.

Marx observes that no society disappears before giving rise to all the potential of which it is capable. Being aware of the dissipation inherent in the capitalist mode of production, he is clear about its trajectory and the scenario of its loss of power. Our current has carried out a long and complex work on the entire second volume of Capital,[26] (in which

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[24] *Entropia, sintropia, informazione*, Arcidiacono Giuseppe e Salvatore.
[25] 'Doctrine of the devil in the body', Battaglia Comunista n. 21, 1951; 'In the vortex of mercantile anarchy', Battaglia Comunista n. 9, 1952.
[26] Marxist economic science as a revolutionary program , Notebooks of *n* +1.

Marx already speaks of the 'potential non-existence of capitalism'),[27] in order to arrive at illustrating the final level of the wastefulness of an ultra-dissipative mode of production. Bordiga notes that Engels, when editing the second volume for the press, had not realised that Marx did not want to highlight so much the administrative wretchedness of capital as the immense wastage that occurred precisely in the area of the historical change of the destination of relative surplus value, which in ever greater part was devolved to rent, as he would later write in the third volume, where he describes the law of the tendential fall of the profit rate with the criteria of a research on the degree of dissipation in a world of machines.

In order to reproduce itself, capitalism must develop associated labour, increase dead, objectified, 'crystallised' labour in capital, but in doing so it denies itself by implicitly developing the foundations of future society. Big industry has generated productive forces for which private property has become an obstacle similar to what the corporation was for manufacturing. The process has reversed itself from the early phase of bourgeois society: and today, in an apparent paradox, we can see that from the existence of islands of communism in a sea of capitalism, we have arrived at islands of capitalism in a sea of communism. The internet connects everything and everyone in real time. The old envelope no longer corresponds to the content that presses to break free, this content is nothing more than a less dissipative, lower entropy social form.

Without a theory of social transitions, one cannot understand how the current form is evolving, and where it is going. Such a theory is not to be invented, it already exists and is condensed in the pages of Capital, in the Manifesto, in State and Revolution, and in the other pivotal texts of communism. In epochs of revolution, where chaos seems to reign, there is always an underlying order, there is an attractor placed in the future, and attention must be paid to this. In the context of complexity theory, in addition to talking about deterministic chaos, the concepts of emergent order and strange attractors are introduced (Edward Lorenz). If regularities can be identified even in perturbed systems, this means that it is possible to do science.

In the text "Doctrine of modes of production",[28] from which we have taken the title of this journal, n+1 ('*If the social forms or modes with capitalism have been n, in all they are n+ 1. Our revolution is not one of many, but is the one of tomorrow; our form is the next form.*"), it is shown that although individual economic and social formations have their own internal laws of development, the succession from one form to another is possible because contradictions are present in each form that bring it into conflict with the further development of the productive forces. Each mode of production produces internally the basis for the development of the next.

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[27] *"Now we come to reproduction. Assuming that the capitalist consumes the entire surplus value and limits himself to reconverting the original quantity of capital into productive capital, his demand will be equivalent to his supply... To suppose this is to suppose that capitalist production does not exist, and therefore the industrial capitalist himself does not exist. In fact, capitalism is already suppressed in its foundations if it is assumed that enjoyment and not enrichment is the determining factor."* (Marx, *Capital* , Book II chapter IV)

[28] *Il programma comunista*, n. 3-4-5-6 of 1958.

11. Teleology in the Time of Cybernetics

In nature, there are many examples of action directed towards the pursuit of a goal (plants reaching out towards the light), and not only in the biological field, think for example of missiles that have to hit a moving target, and to do this they have to self-correct their movement in flight.

It was in the military field, during the Second World War, that mathematician Norbert Wiener's studies on cybernetics, which literally means 'art of control', began. Together with engineer Julian Bigelow, Wiener was engaged during the war in a project to automate American anti-aircraft artillery.

It was at a multidisciplinary conference in Princeton in 1945, organised by Wiener and von Neumann, that the idea was born to found a study group, called the 'Teleological Society', that would deal with negative feedback systems (i.e. those systems in which the output signal acts backwards, stabilising them). The project did not have a long life, but on the other hand, between the 1940s and 1950s, the 'Macy Conferences on Cybernetics' were held in New York. These were dozens of meetings sponsored by the Macy Foundation, a private philanthropic organisation, whose aim was to promote interdisciplinary approaches between the social and physical sciences in an attempt to arrive at a unity of science. Dealing with the intentional behaviour of organisms and machines through the same analytical tools was only natural in that environment that saw the participation of illustrious scientists such as Warren McCulloch, Walter Pitts, Claude Shannon, Heinz von Foerster and Gregory Bateson. Among the topics covered were: self-regulatory and teleological mechanisms, simulated neural networks, computers learning to learn, analogue and digital approaches to psychological models, language and information theory, homeostasis and learning.

Returning to Wiener and Bigelow's work on anti-aircraft, the system they devised was, and is, composed of a radar ('radiolocation and distance measurement') that scans the course of the aircraft to be shot down. The radar sends a signal to a computer, and this, having worked out a prediction of the future position of the aircraft, sends it to the gun that fires. After the first shot, the radar verifies the new position of the aircraft and sends the information back to the cannon that is about to fire a second one, and so on. This mechanism of sending the output data back to the input is nothing more than a negative feedback process.

Research on mathematical models related to the detection and aiming of anti-aircraft batteries was also being carried out in the Soviet Union at that time, with the school of mathematician Andrej N. Kolmogorov, who also dealt with the entropy, or loss of information, on trajectories.

The subject of feedback was further explored in Wiener, Rosenblueth and Bigelow's article, 'Behaviour, Intent and Teleology' (1943), which laid the foundations for a unified

method of analysing the functioning of machines and organisms, by means of the science of control and communication. A study that would be continued and deepened by Wiener in his book Introduction to Cybernetics (1948) with the subtitle Control and Communication in the Animal and the Machine.

For Wiener, Rosenblueth and Bigelow, as for Aristotle, "*the end comes first*", and they demonstrate this by resorting to the principles of cybernetics: according to von Neumann, concepts such as function and form cannot be thought of without thinking of an end that orients them.[29] However, in their view every process directed towards an end can be said to be teleological, and they do not give this term a religious or philosophical meaning.

The aim of their article is to highlight the importance of the concepts of behaviour and purpose (synonymous with aim, goal, objective) in cybernetic systems.

By behaviour, the three scientists mean 'any change of an entity with respect to its environment'; it can be goal-directed or random. Active behaviour is where the object can store energy that arrives from outside. In passive behaviour, on the other hand, as in the case of a stone thrown towards a target, all the energy of the output can be attributed to the input. There is no filter inside the object.

Active behaviour can be divided into two classes: causal or purposive behaviour. Behaviour directed towards a purpose, i.e. towards an end, can be divided into two sets: 'with feedback' (or 'teleological') and 'without feedback' (or 'non-teleological').

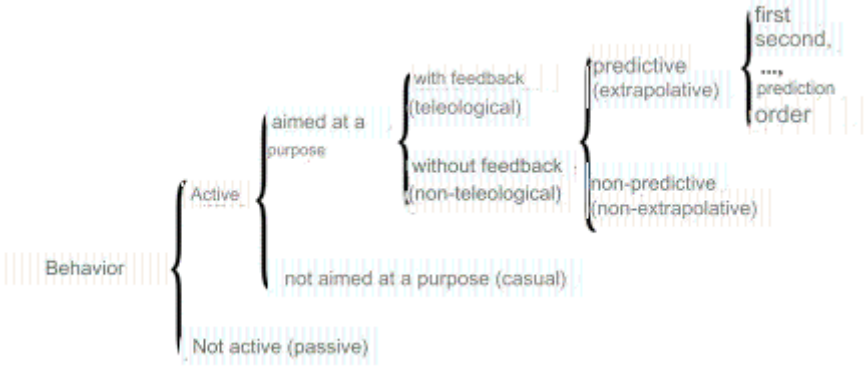
Any behaviour, whether of a living being or a machine, that is directed towards a télos is a process that requires negative feedback. In fact, if a goal is to be achieved, signals need to depart from it at a certain frequency to regulate the behaviour. Let us think, as we said at the beginning of the chapter, of an intelligent missile that modifies its trajectory in relation to the change in position of the target: this is an artificial homeostatic mechanism.

Purpose-directed behaviour with feedback can be either extrapolative (predictive) or non-extrapolative (non-predictive).

Predictive behaviour can be divided into various orders:

> "The cat chasing the mouse is an example of first-order prediction; the cat simply predicts the mouse's path. Throwing a stone at a moving target requires second-order prediction: both the trajectory of the stone and that of the target must be predicted. Examples of higher-order prediction are hunting with a sling, or the bow."

[29] The principle of least action and finalism in mechanics, Giorgio Israel, *Le Scienze* , n. 346, June 1997.



For Wiener, Rosenblueth and Bigelow, teleological behaviour is therefore behaviour directed by negative feedback, which makes it possible for the object, living or non-living (a cat or a missile), to reach its goal, even when it is in motion. The word 'teleology' used in cybernetics, as we have already noted, has nothing religious or philosophical about it:

> "Teleology was discredited primarily because by definition it required a cause chronologically subsequent to a given effect. When this aspect of teleology was abandoned, unfortunately so was the relative recognition of the importance of the concept of purpose."

According to the definition given by the three scientists, teleology is thus not opposed to determinism, but to non-teleology. Analysing machines and humans with the same criterion (i.e. treating them as organised systems composed of input, transformation and output) may seem a stretch to many, but in light of the fact that machines are learning to learn autonomously, it is less and less so.

To clear the field of misunderstandings around the concepts of finalism and cybernetics, we can take a very simple example, that of the air conditioner. Some call it a 'heat pump' or even an 'inverter'.

If energy is supplied to it, it cools the hot or heats the cold. Better said, it shifts each of these two conditions by reversing the flow of heat (which spontaneously in nature always goes towards the cold). Depending on the precision of the components, it is one of the best tools we can use to give our biological equivalent a helping hand when average conditions change.

Its homeostasis is achieved through a simple component, the 'thermostat'. It contributes to the purpose for which it was invented, applied and calibrated. A mechanical product that tells us how we are related to each other within the environment in which we operate. Whichever way you look at the system that results from the assembly, there is only one physical evaluation criterion and it is called 'performance'. This efficiency is always less than 1 and is the key to the second principle of thermodynamics.

Is there a teleology/teleodynamics of the thermostat or is it in the head of the man who invented it after feeling the need for it to operate some device?

Reasoning about the thermostat is fractal in nature for all the models that can be realised in the universe known today, including some of its currently ambiguous laws. On the other hand, cybernetics is the discipline that deals with everything that transmits information and studies ways to use it to achieve some purpose.

12. The Energy that Comes from the Sun

Let us briefly review the first and second principles of thermodynamics: 1) energy is conserved, it does not disappear into nothingness, it passes from one form to another; 2) in an isolated system, disorder increases.

If it is true that energy is conserved, then why is it that when wood is burnt it can no longer be used for heating or cooking? The second principle answers this question: the degree of disorder in a closed system tends to increase spontaneously. In order to restore order, energy is needed from outside, and the only source of energy that makes life on Earth possible is that which comes from the Sun, the closest star to planet Earth.

Let us ask then how life came into being and differentiated, and how a superior social form will emerge from the disintegration of capitalism. The two questions are closely linked and so are the answers. All biological and social systems are kept in order through the energy that comes from the sun, think of photosynthesis, that is, the ability of plants to capture the energy contained in the sun's rays and use materials such as carbon dioxide in the atmosphere and water in the soil, to generate new order. Within the plant there is a production process (like in a factory) from which come out ordered materials, such as sugars, cellulose, lignin, leaves and fruits, which serve as food for animals.

The system that holds the Earth and the Sun together can be considered for simplicity of analysis as a closed system: if the light bulb, the Sun, goes out, goodbye order on our planet (if we want to draw a comparison: the source of energy from which capitalism draws nourishment is labour power, if this for certain reasons stops producing surplus value it goes out).

In short, it is only thanks to the nuclear reactions occurring in the mother star of the solar system that biological organisation is possible. Preclass societies, which had not yet cut the umbilical cord that held them organically united to the rest of nature, had elaborated sun cults (Ancient Egypt, Maya, Incas, etc.), sensing that the energy necessary for life on Earth radiated from that high place in the sky:

> "If, under the guise of the dreary Catholic saints, the very ancient form of non-inhuman deities, such as the Sun, still lives on, this is reminiscent of the news - how misrepresented to us! - of the Incan civilisation, which Marx admired. They were not primitive and ferocious enough to immolate the most beautiful specimens of the young species to the

Sun that demanded human blood, but splendid with a mighty intuition, those communities that recognised the flow of life in energy, which is the same when the Sun radiates it on the planet and when it flows into the arteries of the living man and becomes unity and love in the one species, which as long as it does not fall into the superstition of the personal soul with its sanctimonious balance of give and take, the superstructure of monetary venality, does not fear death and does not ignore that the death of the person can be a hymn of joy, and a fruitful contribution to the life of humanity. " ("In Janitzio death is not scary")[30]

Like that ancient knowledge which, although naive, were the manifestation of an achieved social harmony with the environment, communist theory explains the thermodynamic relationship between man and the Sun, and does so with the tools and methods of tomorrow's science-knowledge, critical of the double-entry economy of this declining society:

"For Marxist science, although there is no land rent that is not exploitation of man, appropriation of value, payment of society to the peasant, the agricultural product is the product of nature, since man and his labour are also. They are, in fact, the product of an infinitesimal part of the energy that the Sun diffuses in space and that, upon meeting the Earth, gives rise to the chemism of life. In the classless society no one will 'appropriate', no one will 'pay'; in it, having rationally resolved the man-nature relationship, the species will not need to separate the work of man from that of the Sun." (cf. Introduction to the Agrarian Question, 1953).

The photons arriving from the Sun carry much more orderly energy (high-frequency 'yellow' photons) than the Earth returns to the cosmos (low-frequency infrared).[31] The Earth returns the same amount of energy that it receives from the parent star, but that which it receives is at low entropy. If we wanted to describe the energetic functioning of our planet with systems theory, we could represent it with the black box model: an input, more ordered energy arriving at the Earth, and an output, more disordered energy going out.

The chemist James Lovelock, who worked in the 1960s for NASA on research into the characteristics that a planet must have for life to manifest itself, considers our biosphere to be a unique organism capable of self-regulation, and demonstrates this with the 'daisy scheme' (Daisy-World model), which is then a Lotka-Volterra equation, better known as the prey-predator model. This model leads to the conclusion that the more white daisies, which absorb solar radiation, increase on Earth, the lower the temperature becomes, and thus the black ones, which repel radiation, increase. The computer simulation of such dynamics can be made much more complex by introducing variables. In any case, the model shows how the planet is able to regulate its temperature to make the continuity of life possible. For Lovelock (Gaia. New Ideas on Ecology):

"One of the salient properties of all living organisms, from the smallest to the largest, is their ability to develop, operate and maintain systems that set a goal and then struggle to

[30] Il programma comunista n. 23 in 1961.
[31] The Road to Reality, Roger Penrose.

> achieve it through the cybernetic process of trial and error. The discovery of such a system, functioning on a global scale and aiming to establish and maintain optimal physical and chemical conditions for life, would certainly provide us with convincing proof of Gaia's existence."

Gaia is the set of organic and inorganic components that make up planet Earth. If, as a human species, we do not bring ourselves back into harmony with the rest of the biosphere, we run the risk of extinction, as numerous studies are now proving. Also because, as the philosopher of science Telmo Pievani notes: '*The biosphere is necessary for the survival of man, but man is not necessary for the biosphere*'.[32]

Marx, in unsuspected times, when ecology and the limits of development were not yet being discussed (Club of Rome, Mondo3 model), had posed with a scientific approach the problem of the breakdown of 'social metabolism' due to capitalist development with its increase in waste:

> "Large landed property reduces the agricultural population to a continually decreasing minimum, contrasting it with an industrial population crammed into large cities and continually increasing; it therefore generates conditions which cause an irremediable rupture in the fabric of the social metabolism prescribed by the natural laws of life, as a result of which the resources of the earth are dissipated, and trade extends this squandering far beyond the boundaries of the respective country."[33]

The only way to be in continuity with the biosphere is to move to another, designed, non-anarchic social form. Ecological critiques of consumer society, such as those advanced for example by John Bellamy Foster (Monthly Review), a theorist of the 'metabolic divide' and advocate of an eco-socialist praxis aimed at the perpetuation of bourgeois political categories such as equality, democracy and freedom, remain within the framework of that system which one would like to 'correct'.

Stances are not enough to stop a mode of production that has become completely autonomous with respect to the needs of the species. Capitalist urbanisation is growing like a cancer, interrupting the organic exchange between man and nature and causing disasters on an ever-widening scale. Those who deal with technological forecasting and systems engineering, such as the mathematician Roberto Vacca, note that there are limits whose exceeding them necessarily causes catastrophes. In his essay Medioevo prossimo venturo (The Middle Ages to Come), Vacca focuses his analysis on the degradation of large systems; in his novel La morte di megalopoli (The Death of Megalopolis), any one incident triggers a domino effect that has repercussions from one city to the infrastructure and logistics of an entire country. Today, such scenarios are not so science-fictional: supply chains move goods, and thus use values, from one part of the world to another, and if for

[32] Sempre più soli, Maurizio Casiraghi.
[33] Capital . Book III, chapter 47 – 'Genesis of capitalist land rent'.

some reason they break down, metropolises of ten or twenty million people are left without food, water, medicine and electricity with easily imaginable consequences.

Faced with this situation, it is not a matter, as the eco-primitivists do, of invoking an impossible ideal return to the past, to self-sufficient and decentralised local communities, but of leveraging the elements of the future present in this mode of production to facilitate its disappearance:

> "The revolutionary elements that will eliminate the old division of labour and the separation of town and country by revolutionising all production, are already contained as germ in the productive conditions of modern big industry (Friedrich Engels, Antidühring)."

In the book Half the Earth: Saving the Future of Life, the biologist Edward O. Wilson proposes, as a solution to save the Planet's biodiversity and thus the life of our species, that half of the Earth's surface, or a larger part, should be set aside as an inviolable nature reserve. This is an interesting proposal, but it would have to be explained how to implement it in a world that is divided into nation-states, with each of them fighting against the other for market shares, making coordinated global action completely utopian.[34] Complexity theories tell us that one cannot understand a dynamic system without a clear view of the elements and the vast network of interactions that enable it to sustain itself.

As physicist Léon Brillouin states in Life, Thermodynamics, and Cybernetics:

> "The Earth is not a closed system, and life feeds on the energy and negative entropy that seeps into the Earth system. [...] The cycle works like this: first, creation of unstable balances (fuels, food, precipitation, etc.); then the use of these reserves by all living creatures."[35]

The Gaia system, which produces the conditions of its own existence, is a living system, struggling united against entropy, as in the famous film Avatar by James Cameron, where the figure of capitalist man clearly appears, who, unlike the other species, does not participate in the development of life on the planet but stands as an external and antagonistic element to it.

The Gaia Hypothesis, developed by Lovelock in the 1970s had been anticipated by von Bertalanffy with the general systems theory, which considers the world as something that is more than the sum of its parts: the system-world is composed of subsystems that are related to each other, which are structured according to a hierarchical principle (cells forming tissues, these forming organs, and so on). The reason why these theories arose in a

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[34] 'Revolution and cybernetics', *n* +1 n. 46: *'We have transferred our faculties to the Planet, only that the Planet does not have a central unit to direct the mass of information we produce. Instead of one centrally regulated organic metabolism we have two hundred nation-states; instead, we have a harmonious relationship between the parties: police and armies; instead of the pursuit of balance through a biological process (bio = life) we are complacent in our antibiotic repressive efficiency.'*

[35] The Information , James Gleick

certain period is to be found in industrial society's need to arrive at a systemic view of itself: the 'retification' of the world demands it.[36]

If it is correct to regard planet Earth as a living being, then communism is not only a requirement of the human species but a requirement of the entire biosphere, hence it is universal in nature. We are sure that such a definition of communism will horrify those who understand it as a political fact, due to the manoeuvring capacity of the party-battler of the moment, we are sorry, but we have arrived at these conclusions by deterministic means starting from what Marx wrote in the Manuscripts of 1844.

13. Evolution vs Entropy

During the 19th century, two worldviews clashed: one based on evolution, and thus on the growth of order in nature (Darwin), and one based on thermodynamics, which sees the world as tending towards chaos (Carnot). But we realised that there cannot be two opposing truths to explain what happens in nature. So what?

Let us begin by saying that in the last century, the hypothesis emerged, later formalised and proven, that the second principle of thermodynamics and information theory could be represented with not only similar but identical formulations. In short, this means that deterministic processes, regardless of time, are perfectly reversible.

The living absorbs energy and information by taking on new order in its structures and thus, in an open universe, new order is formed by energy-matter exchanges. Bertalanffy addresses the problem by arguing that living organisms are open systems, in dynamic equilibrium, and therefore do not respond only to the second principle of thermodynamics, as is the case with closed systems. Organisms delay thermal death because they continuously exchange energy and information with the outside world. Without openness to the outside world, the production and reproduction of life is not possible. Living beings are not static systems, always containing the same components, they are systems in a '*quasi-steady state*'.

Humberto Maturana and Francisco Varela, theorists of autopoiesis, i.e. the ability of living systems to reproduce themselves, take up the argument by specifying that living systems are "*organised in a closed causal circular process that allows evolutionary change in the way circularity is maintained, but not the loss of circularity itself.*" (Autopoiesis and Cognition)

Openness is needed to exchange energy and information with the external environment (Bertalanffy), but organisational closure is equally necessary to preserve the existence of the system (Maturana, Varela).

[36] *Wherever we see life forms, we can see networks'* (The science of life)

We can say that, dialectically, living systems are closed and open at the same time. The cell, for example, is composed of a membrane that opens and closes continuously. If there is no circularity, it is not possible for a living being to exist, which, being a system, has an identity; conversely, if it were totally closed, it would not be alive. This dynamic also applies to that particular organism that is the party of the revolution, as we wrote in the article by the name 'In the broad and narrow sense' (n+1 no. 39 April 2016): whenever political work is carried out in a network mode, it is by definition, at the same time, open and closed, hence common and collective.

Bertalanffy adds to classical thermodynamics the thermodynamics of open systems, on which other scientists will also work, such as Ilya Prigogine and Isabelle Stengers, with their studies on dissipative structures (or dissipative systems) that inject more entropy into the environment than they absorb. For Prigogine and Stengers, dissipative systems absorb energy at a high thermodynamic value and export degraded energy at a low value. In their scheme, the second principle of thermodynamics is respected: dissipative systems, whether living organisms, cyclones or lasers, maintain their order and increase it at the expense of the rest of the universe (we deduce that there must also be some coordination in atomic processes).

Up to this point, Prigogine and Stengers' theory works well, some problems arise when the world of open systems is described as indeterministic. For them, determinism and the reversibility of processes only apply to limited cases in physics and biology: it is the triggering fluctuation, random and microscopic in nature, that can generate a macroscopic change capable of invading the entire system. In order to affect the system, it must stabilise in a limited spatial region:

> "We can consider dissipative structures as giant fluctuations conserved by a flow of energy and matter. They are indeed the result of fluctuations, but, once formed, they can be stable with respect to a large class of perturbations." (Prigogine and Stengers, The New Alliance)

Life, according to the authors, would arise from chance. But mathematician René Thom (Enough with the case, shut up the noise) debunks this thesis, showing that life is not an irreducibly random element, because every 'story' of the individual possible paths of matter is related to the universe of adjacent stories.

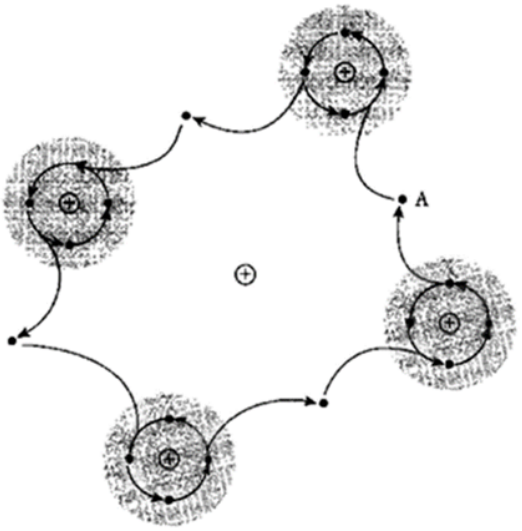


Figure 2. Schematic representation of a Manfred Eigen "hypercycle".

Manfred Eigen, winner of the Nobel Prize in Chemistry in 1967, came to the conclusion that the origin of life on Earth is not the result of chance, but is the result of a process of organising non-equilibrium systems. Eigen's hypercycle is a loop of reaction cycles between self-organising entities formed by positive feedback. Life is a chain of reaction cycles that promote their own synthesis. This theme was later taken up by Stuart Kauffman with his theory of self-catalytic systems, i.e. capable of catalysing their own formation.

For Kauffman, life originates by means of replication mechanisms of various dimensions that played a fundamental role in the formation of the first living organisms. It is still a matter of study to establish at what exact point in the evolutionary process the prebiotic world produced the biotic one. When studying phase transitions in biology, as in society, one inevitably comes to the conclusion that there is always a morphological continuity from one form to another, but at the same time there are breaks, as in Gould's 'punctuated equilibrium theory'.

Underlying the appearance of life is a pre-biological phase, which Eingen calls molecular self-organisation. The living originates from the non-living, as was already claimed by the Russian biochemist Aleksandr Oparin (The Origin of Life, 1929), who identified chemical self-organisation as the origin of life. Demonstration would come later in the 1950s, in America, with the Miller-Urey experiment (after the surname of the two chemists), in which inorganic substances were stimulated in the laboratory by electrical discharges, simulating lightning, producing the formation of organic molecules such as amino acids.

The study of the transition from non-life to life is open, and also concerns the new form of intelligence that is improperly called 'artificial', and which is suddenly transforming the whole of society

14. The Science of Organisation

The Russian revolutionary Aleksandr Aleksandrovič Bogdanov, whom Lenin harshly opposed, was also a doctor, and long before the scientists we have mentioned, he had addressed the question of organisation in the text Tectology, which means precisely the science of organisation, understood as a method of studying the continuous evolution of material forms. In order to explain what he means by organisation, Bogdanov gives the example of building a house: to start with, you need a series of materials and tools, and you need various professionals. Putting all these structures together, including workers, connecting them and organising them 'gives rise' to a house, which is more than just the sum of its parts. Whereas before there are unconnected elements, when the construction is completed there is something more, there is an 'organised' system. There is a concentration of matter and energy through organisation, i.e. through an order.

Underlying Tectology is the idea that all human activities, from the most basic to the most complex, are organisational processes. The universe, for Bogdanov, is a self-organising totality. The Russian revolutionary noted that the application of organisational concepts in practical life and science was becoming more and more widespread, and would one day lead to the formulation of universal methods for solving problems. The future will bring the unified organisation of things, people and ideas, the connection of all three elements in a dynamic and harmonious manner. For Bogdanov, all of humanity's interests and tasks can be traced back to organisational factors.

The physicist Fritjof Capra, who has always been interested in systemic and holistic thinking, but also in the new age and ecologist world, in his essay Life and Nature, written together with the chemist Pier Luigi Luisi, addressing the themes of symbiosis and cooperation in nature, recalls the importance of Bogdanov's work for the development of the science of complexity:

> "Bogdanov showed how organisational crisis manifests itself as a rupture of the existing systemic equilibrium and, at the same time, represents a transition to a new state of equilibrium. By defining crisis categories, Bogdanov even anticipated the concept of catastrophe developed in the 1960s by the French mathematician René Thom, which later became a key concept in complexity theory under the name of 'bifurcation'."

Capra then questions Richard Dawkins' notion of the 'selfish gene'. Indeed, the theory of the gene struggling in isolation to ensure its own survival and transmission is not convincing, any more than that of the abstract Robinsonian individual, isolated from the species and self-sufficient.[37] It is necessary to move from a reductionist approach to a holistic one, which is best suited to explaining the dynamics of biological development (Bordiga quoting Bertalanffy in Factors of Race and Nation: '*a single rabbit is not a rabbit, two rabbits only can be a rabbit*'). The basis of life is cooperation rather than competition, collectivity instead of isolation. Game theory shows that those who manage to establish

[37] 'The Marxism of the cacagli', *Battaglia Comunista* n. 8, 1952.

alliances and not those who remain isolated have a better chance of survival. Cooperation can be seen both at the genetic level and at the level of multicellular organisms where it is necessary for the formation of cells and tissues.

Capra asks how a cell or organ has the knowledge that it is part of something larger. The answer, he says, can be found in the field of systems biology, which studies living organisms by focusing more on their interactions than on their parts.

Every living being is endowed with some form of cognition, (Maturana, Varela). Cognition, i.e. the process of acquiring data about a given system, is at one with the process of life. Living beings are cognitive beings, at every level, from the smallest to the largest. Cognition is the activity that underlies living networks. Mind is immanent to matter, as Giacomo Leopardi said in Zibaldone: if we think, it means that matter feels and thinks. We are not made of a different matter from the rest of the universe.

Materialism has many fathers and going back in time we can remember more than one.

For Giordano Bruno, human beings are no different from the rest of nature, they are one of the many life forms that populate the planet. As a good materialist, he notes that the main characteristic of our species is the hand, which allows it to build tools, to work, activities that differentiate it from other animals. The universe is an organism made up of a single matter and substance. Bruno was inspired by the theories of Lucretius (De rerum natura), according to which "nature is not subject to proud masters. It does everything by itself and without divine intervention." Lucretius, in turn, was based on Epicurus' theories that reason does not come from heaven (Hyperuranium), as Plato thought, but from matter, which has the capacity to give itself order, to self-organise.

Even the simplest organisms have cognition, even the amoeba looking for food in its environment 'decides' to go where it is abundant and not where it is scarce. The myxomycetes, also known as mucilaginous fungi, when a critical threshold represented by the lack of food in the surrounding environment is exceeded, merge into a single body in order to procure the little nourishment available and use it rationally. These amoebae emit a substance (cAMP, cyclic adenosine monophosphate) that acts as an aggregator, and although there are no leading myxomycetes organising the others, the individual units spontaneously join together to form a superior biological organisation. Examples of similar self-organisation are found in social insects, which communicate with each other through 'stigmergy', i.e. through the release of a marker, the pheromone.

Symbiosis is the basis for the formation of life. There are many cases of association within a species and between different species, plant and animal. Some studies note that in our organism as many as 90% of the cells are non-human. And the gut microbiota, better known as the bacterial flora, the sum of the microorganisms living inside the human gut (bacteria, viruses and eukaryotes), is crucial for regulating vital functions. Some argue that the sum of these microorganisms can be compared to an additional organ, and that the gut

microbiota communicates directly with the brain via the nervous system. In nature, there are many instances of symbiotic life: birds feeding on parasites of pachyderms, small fish doing so with large fish, etc.

Species that practise symbiosis and mutualism have a common goal, which is their own reproduction. Between the bird that feeds on parasites and the elephant that hosts it, a system has been established, a form of organisation between different species that has proved successful for both.

Edward O. Wilson, in his book The Social Conquest of the Earth, tells the story of eusociality, the characteristic of those species "*in which there are multiple generations organised into groups through an altruistic division of labour*". The eusocial species (ants, bees, wasps, termites and humans) are those in which individuals in their workings form superorganisms.

The view of evolution as a product of interconnectedness was anticipated by the Russian botanist Konstantin Mereschkowski, who in 1905 in the course of his research on lichens formulated the theory of symbiogenesis: larger, more complex cells evolved from the symbiotic relationship between less complex cells. Evolution occurs by hierarchical jumps, i.e. by subsumption. In his book 'Mutual Support', the anarchist scientist Pyotr Kropotkin argues that the living species that have adapted best are those that practise mutual support, and suggests that mankind should do the same (although he later contradicted himself by becoming interventionist during the First World War).

Another Russian scientist who adopted a systemic view is Vladimir Vernadsky, forerunner of Lovelock's Gaia Hypothesis. He trained scientifically in late 19th century St. Petersburg, a city rich in political and cultural ferment. He graduated in natural sciences, visited many European countries and participated in numerous scientific congresses. Starting with research on mineralogy, he broadened the horizon of his studies by founding disciplines such as geochemistry and biogeochemistry, and wrote the pioneering book 'Biosphere', in which he describes life on Earth as if it were a single organism:

> "The biosphere is as much, if not more, a creation of the Sun than it is a manifestation of terrestrial processes. [...] It can, in its essence, be regarded as a region of the earth's crust, occupied by transformers that change cosmic radiation into active terrestrial energy, electrical, chemical, thermal, etc. Cosmic radiation from all celestial bodies extends to the entire biosphere, passes through it and everything in it. [...] The study of the influence of solar radiation on terrestrial processes allows us to gain a first precise and profound idea of the biosphere from a scientific point of view, as a mechanism at once terrestrial and cosmic. The Sun has radically transformed the face of the Earth, it has traversed and permeated the biosphere."[38]

[38] W. Vernadsky, La biosphère

In the early 20th century, a scientific explosion took place in Russia, laying the foundations of modern systems theory. This country experiencing an epoch of revolution becomes a research laboratory in all fields. The bubbling of studies and research passes through the curious current of thought that is cosmism, a movement that is half esoteric (Nikolai Fëdorov) and half scientific (Konstantin Ciolkovskij), one of whose objectives is the colonisation of other worlds by means of space travel. These two souls go through the same October Revolution, backward (mysticism) and forward (science) at the same time.

With the defeat of the revolution in the early 1920s, there is a blockade, or at least a slowdown, in knowledge in Russia, and the counter-revolution overwhelms everything (science, art, etc.). It was only with the birth of cybernetics and systemic thinking in the middle of the last century that authors and theories that had been forgotten, such as those of Bogdanov, were rediscovered. However, the Russian cybernetic school has nothing to envy the others, just think of the 'cyber-communist' projects of the mathematician Victor Glushkov who, in the 1960s, aimed at planning the economy by means of a centralised computer system (OGAS, 'National Automated Accounting and Information Processing System').

An important Russian scientist was Sergey Podolinsky (whose writings were known and appreciated by Vernadsky), who elaborated an energy theory in the second half of the 19th century in his book Man's Work in Relation to the Distribution of Energy. Based on the studies of Marx and Engels (he had established a brief correspondence with the latter), he asserted that in the society of the future there would be no need to distinguish between the work of man and that of the sun. For Podolinsky, labour can be understood as a force, an energy, and thus treated on a par with other ecosystem flows. Almost a century later, in the United States, the technocracy movement was born, made up of scientists and engineers, which proposed the initiation in society of a non-monetary exchange based on energy units, and the overcoming of governments and political parties.

15. Life Understood as a Symbiotic System

We conclude our long roundup of authors dealing with self-organisation by taking a closer look at the endosymbiotic theory developed by biologist Lynn Margulis, according to which life is a symbiotic system that reproduces itself.

Margulis, a collaborator of James Lovelock in the formulation of the Gaia Hypothesis, considers the Darwinian notion of competition-driven evolution to be incomplete, and states that evolution is strongly based on cooperation, interaction, and mutual dependence between organisms. According to Margulis, '*Life did not colonise the world through combat, but through interconnectedness*'.

At the basis of natural evolution would be a cell that 'ate' another cell and instead of metabolising it, kept it inside and developed new capabilities. A eukaryotic cell would have arisen from the fusion of a prokaryote with another organism. According to the scientist, life

arose from preliminary physical cooperation, which at a more advanced stage becomes mutual cooperation between and among different species (families, herds, flocks, tribes).

This is also the case in human society, in its fundamental cell, the factory, where cooperation between individual partial workers is an essential element. In the unpublished Chapter VI of Capital, Marx describes it as a global productive machine in which the partial workers are the individual cells that by cooperating make its functioning possible. Today, production is divided into companies, each fighting against the others, each focused on maximising its own profit.

Margulis breaks with any form of anthropocentrism, stating that it is not true that microbes, and microorganisms in general, are less evolved than we are, since they have been living on Earth for a few billion years before we appeared, and if they have survived to this day, it means that they have found their ecological niche. It is worth remembering that in the long evolutionary chain of living organisms, the human species occupies a very short section: prokaryotes (lacking a structured nucleus) appeared around 4 billion years ago, eukaryotes (with a nucleus clearly defined by a nuclear membrane) appeared a couple of billion years ago, multicellular life (a collection of cells that began to cooperate for the functioning of the whole) a billion years ago, and homo sapiens were born only 300,000 years ago.

The 'higher' beings are made up of microorganisms, which proves that life originated through interrelationships. Taking up Margulis' theories, David Quammen in his book The Tangled Tree, where he writes that almost 8% of the human genome consists of endogenous retroviruses. We are the cooperative integration of creatures living inside us, and this is demonstrated by the fact that in 'each of our human cells reside captured bacteria, long since transformed into mitochondria, without which we could not exist' . Between bacteria, there is a horizontal genetic exchange that suggests that these microorganisms are not to be divided into strains but belong to a single life form. This fact raises big questions about what is a species and what is an individuality. Indeed, one of the questions Quammen asks in the book is: can a single bacterium be called an individual?

We think we are the creators of technology, instead, if we abandon the usual anthropocentric view, we see that bioluminescence existed two billion years before we invented electric light, flight was practised by birds well before the invention of aeroplanes, the locating apparatus of bats existed before the radar, and so on. It is biology that has produced technology. As a species, we have not created anything, if anything, we have organised differently functions that had been present in nature for a long time. Aristotle had already realised that art (derived from 'limb', arm) is an imitation of nature. Today, biomimicry has emerged, a discipline that uses systems from the animal and plant kingdoms as models in the construction of robots and machines. Based on the assumption that in four billion years life has solved a long series of problems by adapting to changing

environmental conditions, it is advantageous to draw inspiration from it for the construction of artefacts and technological tools.

We are nature, as Marx pointed out in the Economic-Philosophical Manuscripts of 1844:

> "That man lives from nature means that nature is his body, with which he must be in constant relation in order not to die. That man's physical and spiritual life is conjoined with nature means nothing else than that nature is conjoined with itself, because man is a part of nature."

The main characteristic of our species is that we have subsumed skills and capacities present around us and organised them differently through work. In the conclusion of the book Microcosm, written by Margulis together with his son Dorion Sagan, it is stated that humans improperly boast superiority over the other species inhabiting the planet in the name of an alleged awareness of how it works, but in reality we too are not fully aware that we are within a system that is subsuming us, that is pulling us into an organism of a superior nature. If we want to visualise this superorganism, we have to think about the interconnectedness of matter, energy and information flows enveloping the Planet.

A macro-life is forming and we individuals are its cells.[39]

> "Perhaps already groups of human beings, sedentary and clustered in communities, cities and electromagnetic communication networks, are beginning to form a circuit that goes far beyond thought, just as thought goes far beyond the concerted swimming of spirochaetes. We are no more likely to be aware of the totality of such a form of group organisation than the individual components of the brain cells, the microtubules, hypothetical vestiges of the spirochaetes, are aware of their own mission within human consciousness." (Microcosm)

All organisms on Earth are relatives, they have a common ancestor. As biologist François Jacob (Nobel Prize winner for medicine in 1965) explains in his essay The Logic of Living, the reality that surrounds us is made up of structures linked together by causal relationships. Every living system, which he calls an integron, whatever its level of organisation, is made up of subunits and, in turn, participates in the formation of higher-level units, which present characteristics that were not present at a lower level. No type of organism could have been formed and reproduced if it had to form itself from scratch. From this Chinese box scheme we arrive at the conclusion "*that living beings are formed by spontaneous association of their constituent elements.*"[40]

Cities live a life of their own, are self-organising, receive matter and information from outside, metabolise it and expel waste. If we see them from above, at night, with the

[39] Thesis also supported by Gregory Stock in his Metaman: The Merging of Humans and Machines into a Global Superorganism, 1993.
[40] The logic of the living, François Jacob.

flashing lights of houses, streets and cars, they resemble a biological being. Indeed, as Telmo Pievani points out, adopting a fractal view of the living:

> "The cell is a very ancient city: it represents the first moment in which evolution took shape. The cell is a city fruit of symbiosis, that is, of coming together by giving up a part of itself in order to take part in something greater."[41]

This being in the making, and of which the majority of individuals are not fully aware, is the social brain, the General Intellect spoken of in the Grundrisse. In those work notes, Marx describes a phase in the development of man-industry in which working time (value) will no longer be the unit of measurement of social wealth, but the amount of free time will be, in which the machine will no longer be in opposition to the worker.

The biochemist and computer scientist Joël de Rosnay, in his book Man, Gaia and the Cyberniont, calls this organism in the making the cyberniont (a word that assembles 'cybernetics' and 'life'), a hybrid being, both biological and artificial, that has the capacity to self-sustain and evolve on a par with other life forms. Other authors have tackled the subject, such as computer scientist Daniel Hillis who, in his article "Close to the Singularity",[42] writes:

> "We are beginning to use calculators that are capable of generating very complex programmes by different methods. Since we do not really understand how they run, we can say that this type of intelligence is overtaking us. As we build faster and faster computers, the process is becoming autocatalytic. We are in the same condition as unicellular organisms when they were converting into multicellular organisms. That's right, we are like amoebas that don't understand what the hell they are turning into."

There is no doubt that, as a species, we are moving chaotically and without a plan but, as we have seen, deterministic chaos theory informs us that even when we cannot see it, there is always an underlying order, as in the case of capitalism within which communism is maturing. Kevin Kelly, who on the study of the ever-closer interpenetration between the world of the 'born' (biological) and the world of the 'produced' (artificial) has built his reputation, notes in his book Out of Control:

> "Even structures that can be likened to organisms - economic societies, thoughts in the brain, ecological communities, states composed of different nations - naturally differentiate into persistent aggregates. Human aggregation institutions - churches, departments, companies - tend more easily to grow than to evolve. If they have to adapt to a situation too different from their origins, most of them disappear."

Capitalism, which is an essentially socialising social form even with regard to the formation of private profit, must adapt to a situation too different from its nature, and thus is doomed to dissolution to make way for a more evolved social form.

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[41] DNA. A code to write life and decipher cancer, Telmo Pievani.
[42] The third culture, John Brockman.

16. The Social Brain

In his book What Technology Wants, Kevin Kelly states that most species are dependent on other species in order to live; on Earth, extensive phenomena of shared life occur, including symbiosis: a famous example is the algae-fungus union from which the lichen arises.

Co-evolution in nature can be explained as follows: 1) each life form depends on other life forms; 2) as nature evolves, species are increasingly dependent on each other; 3) as life evolves, the degree of complexity of social aggregates, i.e. cooperation between members of the same species, increases.

Biological evolution responds to physical laws and is therefore subject to deterministic processes, just like the development of technology as an extension of the social body. Our life is affected by all three levels listed above, and the resulting symbiosis has given rise to a true cybernetic brain, which Kelly calls the technium, and which represents the integration of the world of the 'born' and that of the 'produced'.

There is no manufacturing sector today that is not closely related to IT and networks, which are collaborative by nature. It is estimated that sixty thousand individual man-years of work went into the realisation of Fedora Linux 9 software. Kelly notes how half a million people around the world are working on more than four hundred thousand open source projects (Wikipedia is one of them). All this is made possible by technological cooperation that allows people even far apart to work on the same project: as there is no mediation of value, social energy is released and projects that would otherwise be impossible are realised. Capitalism developed big industry as the basis of the future society, now industry is breaking through corporate walls to spread into society.[43]

Technological mutualism shows that every time we invent something, we do it in an increasingly mutualistic, more shared and cooperative way (see the development of peer-to-peer networks). The network is the fundamental structure of this evolution; it is fundamentally communistic. A single human brain has more connections than there are on the Web, but the brain does not double its amount of connections in a few years as is happening with the Internet. The technium proceeds by assemblies as our brain does, it increases connections, generates patterns, processes data quickly. The technological process is on the verge of changing more in the next fifty years than in the past four hundred, Kelly finally argues.

Jeremy Rifkin, an economist well within the establishment, writes a book on the relevance of communism without stating it openly and without fully realising it: The Zero Marginal Cost Society. The Internet of Things, the rise of the collaborative 'commons' and the eclipse of capitalism. The title itself is a programme, and the interesting thing is that these analyses do not emerge from Marxist or anti-capitalist circles, but from

[43] 'Rottura dei limiti d'azienda', n+1 #04 june 2001.

representatives of the bourgeoisie, elements of the other class, who in the face of conspicuous changes in technological, scientific and social development can no longer see a capitalist future and are forced, by powerful material drives acting in society, to speak of the end of capitalism, perhaps in a utopian, Proudhonian form, but, in any case, to take note of it, filling pages and pages read by a vast audience. Is it not the future that moves the hand of authors like Rifkin? The answer can only be affirmative: revolution finds the tools it needs in all classes.

The very structure of production now openly denies the law of value, denies homelands and states, denies the old ideological and material superstructures. This does not mean that these have disappeared, it means that they are undergoing a process of dissolution: maximally socialised labour is overwhelming the very structure of bourgeois society in a completely automatic process. Revolution, as Engels says, is a purely natural phenomenon (Letter to Marx, 13 February 1851).

The social brain acts from the future on the present and catalyses its own formation. As we wrote at the beginning of this paper recalling Aristotle's thought, it is the final form that is the potential that drives the past. The closer we get to the end of capitalism, i.e. to the advent of the communist society the elements of which this society is already pregnant with, the more pronounced, evident and diffuse the essays on the future become. Hence the recurring phenomenon of the bourgeoisie's ideological capitulations in the face of revolutionary theory, which sometimes become material capitulations.

17. Cyber-Proletariat

Revolution is like a biological reaction, and communists are (or at least should be) the enzymes that accelerate it. The collectivities that in their political workings create a fiercely anti-bourgeois environment[44] are best equipped to face the future; those who linger on worn-out buzzwords and organisational forms can only be doomed to extinction.

The most significant struggles, uprisings and demonstrations of recent years are those that have seen the use of new technologies for their coordination. We have highlighted this in this magazine in various articles, starting with the formidable strike of 1997 at UPS, passing through the riots in the banlieues, the Arab Springs, the 'acampadas' and Occupy Wall Street. In all these episodes, a territorial type of organisation combined with the use of the Internet imposed itself, a modality that broke with the patterns of the past. The most attentive researchers have realised that something profound has changed in the capital/labour relationship, such as Joël de Rosnay, author of the essay La révolte du pronétariat: Des média aux média des masses.

'Pronetaire' is a neologism invented by the author, referring to the Greek 'pro', (in favour of) and the English 'net', with a clear reference to the 'proletariat', a term borrowed from the Marxist tradition. We have no particular sympathy for the innovators, but here we

[44] 'Un programma: l'ambiente', L'Avanguardia, 1° june 1913.

are not dealing with analyses that mature within the communist milieu, but rather in academic circles, driven by maturing social facts. The proletariat, as a class representing the future, has a certain place within capitalist society (it produces surplus value), but as this changes, evolves, is modified, the proletariat too while continuing to produce surplus value, is modified, and with it its forms of organisation. What does not change is the historical goal of its struggle, which is the abolition of the system of wage labour.

For Joël de Rosnay, the collaborative production of the new proletariat, based on networks, represents a revolution on a par with the industrial revolution, which disrupted the old feudal society. Today, thanks to new tools, the Internet above all, the 'pronetaires' are carrying out a revolution that is much faster and more disruptive than those of the past, taking the ruling class by surprise. The author is a bit confused, saying that the object of contention between the two main classes of society, the 'infocapitalists' and the 'pronetaires', is not the one encapsulated in the formula of the surplus-value essay, but it is the online products and services: there are those who want to keep them private and those who want them freely accessible. Beyond the abundant recourse to sociologisms, there is however one interesting insight in the book, and that is the role of information in the class struggle. Because today proletarians are indeed able to use the networks to produce and circulate anti-formist content.

As we wrote in the article 'Information and Power' (n+1 no. 37), with the advent of the Internet a symmetry has been established between insurgents and the state, and the latter no longer has a monopoly on information. The rules of the game have changed.

One often hears it said in Marxist circles that the riots of the last few years, especially those in the banlieusards, are disorganised, have neither head nor tail, and therefore make no contribution to the advancement of the class struggle. In fact, most of the rioters who have taken to the streets own a smartphone and use it to co-ordinate themselves, claim nothing, and attack the symbols of this social form (cars, supermarkets, public buildings). This process of self-organisation has nothing to do with the anarchist matrix conception of the movement proceeding from the idea, but is connected with the modern theory of complex systems, according to which a system is able to process information internally on the basis of a few simple rules: if this thing happens then do this other thing.

This is the era in which millions of people are working for millions of hours for free on some project of collective utility, in which millions of robots are replacing humans in production processes, in which millions of young people are unemployed and will be without a pension because the work is gone, in which the trade unionist claim of the 'right to work' is dead forever.

Some people enjoy 'posting' 'memes' on social networks about 'luxury gay space communism' and similar topics. It is an interesting phenomenon that of the circulation of

content on communism aimed at ridiculing the bleak and holier-than-thou vision inherited from the degenerate Third International. The new generations, more accustomed to scrolling through stories on Instagram than leafing through dusty volumes on the history of socialist Russia, more interested in a life without work than in the construction of the communist state (an obvious oxymoron), are at ease with this type of communication, concise, instantaneous, superficial (not necessarily to be considered in a negative sense), as Alessandro Baricco describes it in his book I barbari: An Essay on Mutation.

For the theorists of 'luxury communism', automation will free us from the slavery of wage labour and allow us to live without economic constraints. Aaron Bastani, author of the book-manifesto Fully Automated Luxury Communism (2019) argues that the 1917 revolution failed by degenerating into 'real socialism' because it was technologically impossible to implement, because the productive forces were not sufficiently developed. In identifying the trend towards automation, i.e. the transformation of what was previously carried out by humans into automated functions, he argues that the only possible demand today is the complete automation of everything and the collective ownership of what is automated. We add, to be precise, that there is no particular demand to be made and that rather than the collectivisation of property, its abolition that is the order of the day.

18. Reversal of Practice as a Unitary Process

Self-organisations: The Mystery of Emergence in Physical, Biological and Social Systems is a book full of insights, we used it as the outline for a paper given at an editorial meeting. However, the authors, De Toni, Comello and Ioan, fail to go all the way, they are not consistent with the premise, to do so they would have to become communists and turn their backs on the world of universities and corporations; instead, what they are aiming at is precisely to give companies tools to keep up with the transformations taking place, and in fact one of the concluding chapters of the essay is entitled 'The most fascinating future for companies: self-organisations'.

The invariant that unites the various parts of the essay is the principle of subjugation, i.e. "*the mechanism that forces the elements of the microscopic level to behave in a manner determined by the organiser, which in turn is created by the parts through their coordinated effect*".

Pushes from the bottom up (top-down) lead to the formation of new order, which feedbacks back down (bottom-up). The dual direction (feedback) between these two levels produces redundancy that makes the structure robust and resilient.[45] The book describes Bénard's cells, i.e. the shapes generated by the motion of a fluid when it is heated, finding invariances with the operation of the laser:

[45] We also find these concepts in the *Milan Thesis* (Il Programma Comunista #07, 20 April 1966): the *'transmission between the molecules that make up the party organ always has a double direction at the same time; and the dynamics of each unit integrates into the historical dynamics of the whole'* .

> "The cells enslave the molecules of the fluid, forcing them to draw the profile that characterises them. There is a reduction in degrees of freedom: from molecules that can move in all directions to cells that are either dextro- or levogyrous. First, anarchic swimmers, then swimmers ordered in a circle. In the laser, from 1016 degrees of freedom of atoms in a disordered state, to a single self-organised degree of freedom."

Are these natural phenomena not reminiscent of what is depicted in the scheme of the reversal of praxis[46] of the Italian Communist Left? Theory and Action anticipates the theories of self-organisation, the text speaks of 'catastrophe theory', 'cusps' or 'singular points', anticipating the modern language of complexity; and above all, it sheds light in political terms on democracy, the tasks of revolution, opportunism, something we certainly cannot expect from bourgeois studies, which would otherwise no longer be so. Revolutionary theory is not an ideology that aims to consolidate itself in the present society, but is already a science of species, since the proletariat is historically fighting for the abolition of itself and thus of all classes, fighting for a society of the species.

The following is a commentary on Table IX - Outline of Marxist centralism:

> 1. The individuals who make up the class are driven to act in discordant directions. Some, if consulted and free to decide, would do so in the direction of the interest of the opposite, dominant class.
>
> 2. Organised trade unions tend to act in a direction contrary to the interests of the ruling class, but in an immediate sense and without the ability to converge to single action and single purpose.
>
> 3. Militants in the political party, resulting from work within the class and associations, are prepared to act on the single revolutionary resultant.
>
> 4. The leadership bodies of the party, emanating from the base, act in the revolutionary direction in the continuity of theory, organisation and tactical methods." (Theory and Action)

Putting the theory of self-organisation at the basis of the study of social systems overcomes the dualism of base/revolution, party/class, subject/object; but the formula 'overcoming dualisms' that Bordiga speaks of (see n+1 n. 15-16) does not mean underestimating the role of the party. It means understanding the formation of the party as a process of self-organisation of the subject. A process that passes through various stages (thresholds), according to dynamics of self-reinforcing circularity.

Those who follow our work will have become familiar with the language we use and thus with our approach to the issues of revolution, but most of those who claim to be communists think of something else: how to build the class union, how to arouse the class struggle, the party, etc. In a nutshell, two political approaches confront each other: the

[46] 'Theory and action in Marxist doctrine', *Bollettino Interno* , n. 1 of 10 September 1951

analytical and the systemic. In the former, one isolates individual elements by focusing on them as such, thus giving rise to the eternal issues to debate (national, trade union, etc.); in the latter, one adopts systemic thinking that connects the individual elements by focusing on the interactions between them.[47] The linear logic is typical of this society, which cares for nothing but the accumulation of capital; in the future social form, a circular logic will be adopted instead, which is then the logic of living things. Nature is not a linear structure, but a network structure whose components relate to each other.[48]

As mentioned, Kauffman calls autocatalysts those systems capable of catalysing their own formation. Declining this formula in the political sphere is like saying that the party catalyses its own formation. The party is both a product and a factor of history (a proposition that is obvious to us, but used by some for activist purposes), and this means that the ordering principle, produced by the movement of social atoms, retroacts on them.

But by what is the polarisation that leads a part of the proletariat to organise itself into a party (attractor placed in the future) determined? This drive is generated by the dissolution of the capitalist mode of production, the profound crisis of the law of value, and a growing social malaise.

Instead of speaking of 'base and summit', giving the idea of a pyramid-shaped party, it would be better to adopt the language of network theory, which is more appropriate to the workings of nature, and speak of the party as a set of nodes and connections. We are made of the same stuff as the Universe, it is good to keep this in mind, and the concepts and terminology of synergetics come in handy here:

> "The sorter makes all the electrons oscillate at one cadence, thus enslaving them. At the same time, it is the electrons themselves that originate it from their synchronous oscillations. Reciprocal conditioning, who is cause and who is effect, circularity: for the electrons to oscillate at a uniform rate, there must be an originator, i.e. the light wave; however, the light wave only originates through the synchronous oscillation of the electrons." (Self-organisation)

The formation of ideas and theories, which are physical processes, can be approached with the principles of synergetics as ideas and theories also respond to self-reinforcing circularity dynamics. The revolutionary theory, the programme, the historical party, imposes itself in society when the pushes from below converge towards it making it a mass force.

Science of revolution and science of nature merge into one, and it is bourgeois society itself that provides us with the tools to verify this thesis.

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[47] Ibid.
[48] 'Revolution and cybernetics', *n* +1, n. 46 November 2019. Available on: https://balanceyavante.comrades.sbs/Pages/Library%20of%20the%20Italian%20Left/lib_txt_2019_revolution_and_cybernetics.html

A new age philosopher like Ervin László (founder of the Club of Budapest, born on the wave of A. Peccei's Club of Rome), studying the theory of systems and the general theory of evolution, arrives at the conclusion that there is a universal law, that of self-organisation, valid for the physical, physico-chemical, biological and ecological spheres. In the universe, after all, all things are connected:

> "Almost 4 billion years ago, photochemical reactions occurred in the upper regions of the Earth's young atmosphere; the products of the reactions were transferred by convection to the planet's surface. Electrical discharges near the surface deposited the products in the primordial oceans, where hot volcanic springs provided additional energy. The combination of energy from the Sun with energy stored beneath the surface catalysed a series of reactions that eventually produced organic compounds." (Resacralising the Cosmos. For an Integral Vision of Reality)

The 'struggle' between natural elements produces new forms and structures; during this struggle, nature comes to know itself and self-organises, producing increasingly complex and diverse organisms. Keeping the organic world separate from the inorganic world is an ideological operation, and indeed when working scientifically on this kind of subject, the bourgeoisie ends up on terrain that is not its own, as the conclusions of the book Self-organisations show:

> "Thus, there are also non-living phenomena in which ordered structures spring from noise. Perhaps it is possible to resolve the paradox of the two contradictory visions of evolution in physics and biology: that of an engine that runs out of steam and that of a living world that everywhere manifests order. Perhaps the living is not idiosyncratic to the non-living. Perhaps the apparent diversity in basic organisational principles is reconcilable. Self-organisation may be the missing link, the bridge that unites what uncomplicated logic separates."

Tomorrow there will be only one science, but we can already adopt this paradigm by proceeding in our work by chained arguments, as our current invites us to do. At the basis of the epistemological dichotomy between the living and the non-living is the old religious concept of the soul; but there could also be a more remote origin that explains this dualism, and it would be traceable in the way we have evolved to adapt to the environment, in automatisms that are triggered in our brains and that have served us, especially when we were hunter-gatherers, to quickly distinguish the prey or the predator (entities endowed with a psychological nature) from what is inert (physical objects).[49]

If this hypothesis has any basis, the revolutionary theory of knowledge is not just a cognitive leap forward but a real evolutionary leap. Through revolutions, the human species

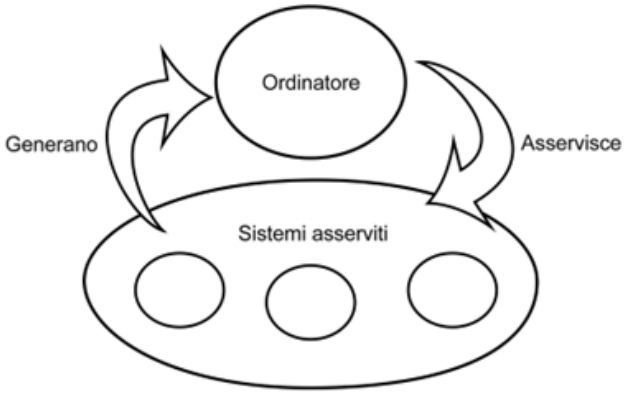
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[49] *'Most people, although willing to accept that animate objects share some properties of physical objects, do not seem willing to admit that we are physical objects, believing instead that we occupy a physical object, their own body. Many people believe, in fact, that there are animate objects, for example saints, who can completely violate the universal principles underlying physical objects, performing miracles, or that in various ways intentional creatures can survive the destruction of their physical bodies (for example in their immaterial soul component or resurrecting as physical bodies after death).*' (*Born to believe* , Girotto, Pievani, Vallortigara)

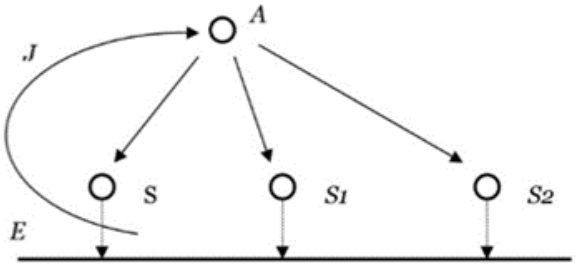
takes leaps forward. There can be no turning back from the furrow traced by the Italian Communist Left, at least because the advanced peaks of the bourgeoisie are forced to adopt a systemic approach to knowledge, driven by the tumultuous development of the productive forces, which are transforming individual industries into cells and organs of a great global industry of which logistics is the nervous system.

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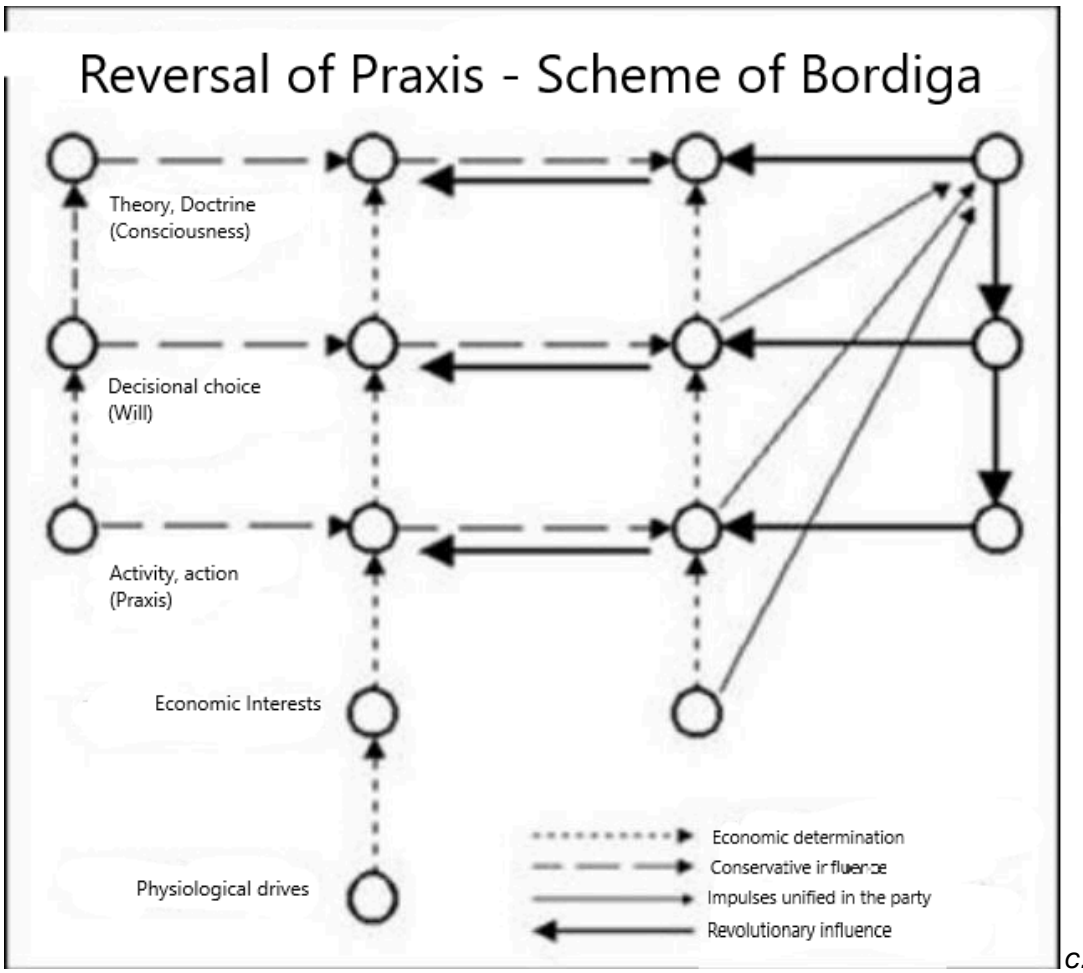
Three schemes are compared below: the first from top to bottom represents a physical, chemical or biological system based on the concepts of 'ordering' and 'enslaved' (synergetics), the second is drawn by Einstein and represents the process of knowledge (from the article in n+1 No. 4, 'Einstein and some schemes of the reversal of praxis'), the third is the Marxist scheme of the reversal of praxis (from Theory and Action in Marxist Doctrine).



a.



b.


Reversal of Praxis - Scheme of Bordiga
Theory, Doctrine
(Consciousness)
Decisional choice
(Will)
Activity, action
(Praxis)
Economic Interests
Physiological drives
Economic determination
Conservative influence
Impulses unified in the party
Revolutionary influence
c.

Recommended Readings

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