# Einstein and Some Schemes of Reversal of Praxis

*Published in N+1 #04 in 2001  Translated by Balance y Avante*

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> *"Ample factual material is indispensable to establish a theory that has any chance of success. This material, however, does not in itself provide any starting point for a deductive theory. I therefore do not believe that there is a path to knowledge by induction, at least not as a logical method. The more theory progresses, the clearer becomes the fact that fundamental laws cannot be found by induction from facts of experience' (Albert Einstein to Michele Besso, Princeton, 20 March 1952).*
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> *"One evening Einstein's words suddenly came back to me: It is theory that decides what we can observe' (Werner Heisenberg, in Physics and Beyond).*

Why Einstein? What does this have to do with a journal on communism? Not only is the relationship there, but we will see, indeed, that in order to reason about communism, we need to get out of the usual catchphrases about communism. We will see that there are no 'difficult' topics at all, there is only mental laziness, inexcusable in general, but especially in those who claim to represent nothing less than the future of mankind.

Theory, Einstein says, derives from our experience of the world around us, but at the same time is not contained in it, it is a specifically human product, an elaboration that we do not find in nature. The corollary is: once theoretical knowledge has been accumulated over millennia, it drives experience. Every theory 'that works' is useful, so man uses it, not every time to discover hot water.

But how do new theories come into being? And how do they impose themselves on humanity, which is so comfortable with the old ones because they 'work'? It would be foolish to think that the old theories are wrong, just because they have been superseded by the new ones. Since mankind as a whole is not as stupid as the individual man, who adopts the dominant ideology even when it no longer makes sense, it has retained, often for millennia, the fundamental knowledge it needed within the limits of its particular use. And it has also abandoned them as soon as they proved to be incomplete, hence insufficient to tackle more complex tasks. Einstein notes that a theory is 'good' when it is based on 'logical completeness', i.e. the principle of invariance according to which 'if only one of the conclusions drawn from a theory turns out to be wrong, it must be abandoned'. So the theory is 'good' when it is impossible to 'modify it without destroying the entire theoretical structure'. Already heard, from Marx onwards.

All scientific theories used by mankind to explain the world, including myths and religions, are 'valid' in themselves. What proves to be anti-scientific is the persistence of ancient beliefs when their internal logical consistency has fallen: Aristotle was not 'wrong' when he drew conclusions from the different fall of the stone and the feather, but Galileo blew up the old logical consistency with an intuitive leap, imagining that the two glued objects would not fall at an average speed and then verifying this empirically. Every theoretical hypothesis is therefore appropriate to the time in which it has its empirical effectiveness in relation to its 'invariance', i.e. the impossibility of scratching a detail without causing the whole construction to collapse. It is not for nothing that millenary religions, unlike science, have to defend their immutability: they no longer have any empirical utility, they do not have to explain anything, so they are by their very nature irrefutable, in the sense that no one can demolish their assumptions in theory, let alone in practice.

Marx demonstrated from the outset that philosophy could not be refuted, but only demolished, since it, with religion, having now exhausted its historical function, was based on pure phrases; hence any philosophical criticism of philosophy could only be conducted with other phrases, a rather pointless task. And he stated, in a formidable passage, that it was now time for a leap into knowledge: '*It would seem correct to begin with the real and the concrete, with the actual presupposition, but on closer examination this proves to be false. I would have a chaotic representation of the whole*'. Hence it is necessary to arrive, analytically, '*at simpler concepts, from the concrete represented to ever finer abstractions, until arriving at the simplest determinations. From here it would then be a matter of undertaking the journey backwards again, until finally arriving again [at the concrete], but this time not as the chaotic representation of a whole, but as a rich totality, made up of many determinations and relations*' (1857 Introduction to For the Critique of Political Economy).

Philosophy interpreted a locomotive as an independent object, arbitrarily isolating it from the material and social whole of which it was part and of which it had a chaotic representation. It discussed the 'concept of the locomotive' without being able to understand the reasons for its appearance and use. In contrast, the science of the future society already knew the whole, had called it capitalism, and therefore knew that the locomotive was not simply an object nor a concept, but a social force (a commodity produced by social labour) that would demolish all the philosophies of the world with all their chatter. Of course, we do not resent philosophy per se, we just have to agree on what it means; after all, this very century has shown that it must merge into science, and thus be negated by it. Human knowledge, says Einstein (with Marx and Engels), is no longer the result of induction, at most it was at the dawn of science, now we proceed by induction-deduction, using existing axioms (established knowledge) and jumping on certain occasions towards more powerful axioms that confirm and at the same time deny the former. The scientist Einstein does not tell us

what these occasions are, nor does an epistemologist who wrote a famous text on these shots, Thomas Kuhn. We do know, however, that the chronology of the sciences and the arts coincides broadly with that of revolutions.

The concept of a deductive 'snapshot', and the consequent explosion of axioms with greater power than the previous ones, was expressed by Einstein on many occasions even in the years before 1952. For example, in his Scientific Autobiography, which dates from 1946, he states in the very first pages: "I distinguish on the one hand the totality of sensible experiences, and on the other hand the totality of concepts and propositions that are enunciated in books". However, he continues, utterances only acquire meaning in relation to experiences. So we have, on the one hand, human praxis, which is the product of the interrelationships between men and their surroundings; on the other hand, theory, produced by men's elaborations on empirical facts. This relationship is at first sight incomprehensible, because Einstein affirms the clear separation into two fields and, at the same time, the absolute continuity between them. In this relationship he sees the origin of the descriptive power of laws with respect to reality, the very possibility for man to know and act according to acquired knowledge (the only one that allows the analytical view of problems), the intuitive explosion, the emergence of new axioms and thus the return to the chaotic whole of reality.

In another article, from 1950, Einstein states, in support of the power of intuition against the pedestrian observation and cataloguing of facts, that every true theorist must ultimately be 'a tamed metaphysician', meaning that while the metaphysician tout-court is wildly enslaved by the idea, the scientist who goes beyond known physics (metaphysics) is the one who manages to understand, and thus master, the material process that drives his intuition. He cannot explain what intuition is (he sometimes calls the intuitive process that seems to bring solutions out of nothing 'creation'), but at the same time he does not renounce a conception of the entire process of knowledge as a continuum in which all barriers are banished between segments, stages and zones of knowledge, between men of the same epoch and between different epochs. This is why he has a rejection of the epistemology of indeterminacy, which entails above all the separation between the sensible, macroscopic world and the invisible, microscopic world, denied to the senses: they cannot be two things, he says, if the macroscopic world is made up of the particles of the microscopic one.

The continuity cannot only be in science, because if 'scientific thought is a development of pre-scientific thought', this means that there can be no separation between life and science either: 'All this applies to the same extent and in the same way to both the thought of everyday life and the more conscious and systematic thought of science', because 'all science is nothing more than the refinement of everyday thought'. In short, the scientist does not have to avoid invading the philosopher's field, as was once thought; on the

contrary, he cannot renounce it: 'The physicist cannot simply leave the critical consideration of the theoretical foundations to the philosopher, because he himself knows best and feels most confidently where the sore point is' (Ideas and Opinions, 1954, cited by Holton). We subscribe, adding that the authentic philosopher stops being a philosopher and becomes a scientist. Science therefore does not superimpose itself on philosophy, but replaces it: it is the cognitive potential that allows mankind to stop with sentences, unless we give philosophy its original meaning, when the term indicated a 'wisdom-friendly' attitude.

As we shall see, both descriptions of the process of knowledge, Marx's and Einstein's, are analogous to the one implicit in the Marxist scheme of the reversal of praxis outlined by the 'Italian' Communist Left in the 1950s.

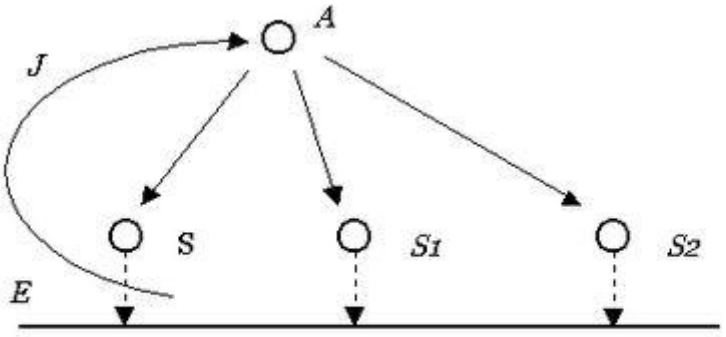



*Fig. 1 - The process of knowledge in Einstein's scheme*

The proof is in a diagram drawn by Einstein himself and which we find in another letter of 1952, this time to his friend Maurice Solavine. A great deal of information is concentrated in a few lines in the diagram (Fig. 1) and we will analyse it a little differently to the author who published it (cf. Holton), while sticking strictly to the original. The totality of empirical facts (or the totality of sensory experiences) is symbolised by an E level; we therefore have at the base of the scheme the physical world that men have at their disposal for their observations. The same one - we add with Marx - of which we have an immediate chaotic representation and which is the only source of our knowledge through sensations. It could not be otherwise, given that human life itself was formed and evolved in millennia of interaction with the very environment that surrounds us. E therefore represents a chaos of elements, a true labyrinth of sensory impressions, about which it is impossible to state with certainty that it is not 'the result of an illusion or hallucination'. Faced with such reality is the scientist, whose task it is to not be deceived by his own subjective perception; and with this we link Marx, Einstein and the Communist Left with Galileo, who, by proposing the translation of reality into mathematical axioms, had the audacity to compare man's knowledge to that of God, if only man had mastered the method with certainty.

The revolution knows no bounds, so Einstein can repeat Galileo almost in the same words: '*Science is the attempt to make the chaotic variety of our sensory experience correspond to a logically uniform system of thought*'. In his scheme, the three constituent moments of the classical Galilean method recur consistently: 1) the critical utilisation of the existing patrimony of knowledge, with which the world is observed and interpreted; 2) the intuitive leap that justifies the 'creation' of a model capable of explaining the phenomena under investigation, isolating their peculiarities from contingent aspects and, above all, from the subjectivity due to the accumulated patrimony of knowledge; 3) the return to empirical reality through experimental verification conducted with the new patrimony of knowledge (the 'test' between theory and practice, cf. fig. 2).

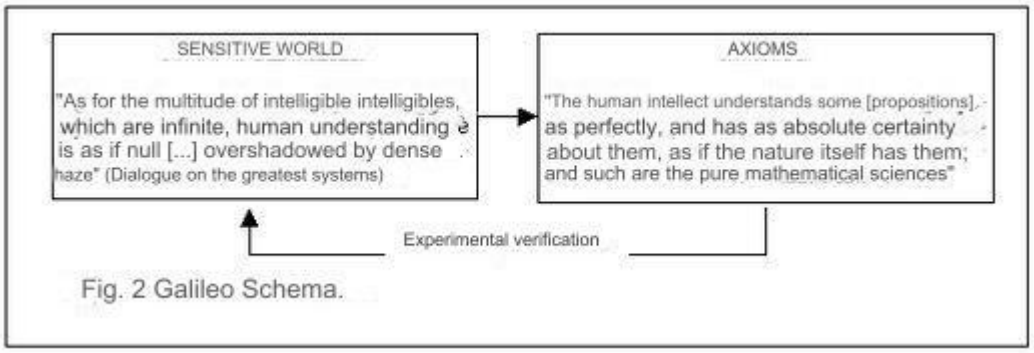


Fig. 2 Galileo Schema.

If laws have been established for a certain field of enquiry, they are to be considered, at least tendentially, 'unifiable'. Since laws are differentiated expressions of phenomena of a unique nature, not reducible into separate and incommunicable fields, they are to be "*discovered*" or "*imagined*", "*with the value of an 'attempt', vowed in history in various senses before coming to grips*". And again: '*The greater the clarity, the more unreal the models. If one wants to do science, it must be communicable and applicable, and then in order to make oneself understood and move forward, one must be, if not summary, then to a good extent simplifying*'.

Neither Galileo, nor Kepler, nor Newton, nor Einstein could 'observe' the reality they described; neither could they rely on previous partial knowledge to be developed in order to derive more complete clues to the existence of new laws. All past beliefs were to be subjected to criticism. Nor did they have the opportunity to experiment with the stars, gravitation or light. Verification necessarily came a-posteriori.

The chaotic set of elements on the E level can therefore only be mastered when a theoretical structure is erected on top of it in order to obtain relations and order between the 'facts', regardless of the specificity of each of them. It must be emphasised that, knowing Einstein's method, within E is represented not only the set of objects and events at a given moment but also its dynamic over time: a set that includes the men who participate in that dynamic and make

history, producing the ideas capable of interpreting it. But if one cannot, as modern epistemology teaches, evaluate a system by placing oneself within the system itself and using its categories, how then does one arrive at a level above E that allows one to master knowledge, establish relations and discover new ordered structures? Basically, this is the same question Marx asked himself: how can political economy, which arose from the capitalist system, judge the capitalist system itself?

In the diagram, Einstein answers by drawing a line J that represents a leap from level E to a higher level A; and he writes: 'A's are the axioms from which we draw consequences. Psychologically A's are based on E's. There is however no logical way from E's to A's, only an '*intuitive connection*'. Here it is important to emphasise that for Einstein the terms 'psychology' and 'intuition' always have a different meaning from the common meaning, otherwise we would not understand the union of continuity and rupture in the continuous line J that represents a break in knowledge. We know that by 'psychology' he meant something very precise, 'concrete', a physical fact. He was, for example, convinced that if telepathy were ever proven to exist, it would be assimilated to one of the normal physical facts already known in his time.

In the text Relativity and Determinism, the Einstenian critique is emphasised not only of indeterminism but also of the 'discrete' conception of the world, the one that conceives of it as consisting of contiguous 'objects', whereas it is rather to be represented as a continuum of fields, relations, energy-matter exchanges etc. In the aforementioned critique, which coincides in full with Marx and Engels' critique of bourgeois thought, just as there is no dichotomy, no clean break, between matter and energy, between macroscopic and microscopic world, between field and particle, so there is no dichotomy between matter and 'thought'. In other words, thought is organisation of matter-energy, as the very matter-energy of which the brains of a Diderot and a Leopardi were made. So, in Einstein, psychology and intuition are nothing more than a part of matter organised into a whole of other organised matter, i.e. the whole represented by the E-level. There is no getting out of here, because we have seen that from such a chaotic set of facts there cannot arise that new information that allows the snapshot in A.

Just as the terms psychology and intuition, so many others: hypothesis, inspiration, suspicion, passion, which Einstein uses without explaining them 'rationally', would not help us understand if we could not connect them to his physical conception of the world. In the very book we are consulting for the topic at hand, there are very well-documented chapters that show how Einstein recognised that he was not a 'creator' of theories, in contrast to the word he himself uses to describe J. He, like others who have marked scientific revolutions, is rather the result of a long process that has seen the crowning of the partial studies of generations of scientists, and he generously acknowledges

this, even beyond the actual contributions of some of them, as in the case of Mach.

The scientist who is placed by history at the apex of a process, Einstein says, may not even be aware of what it means to arrive at the decisive 'intuition'; and in his Scientific Autobiography he recounts: '*Little by little I began to despair of the possibility of discovering true laws through attempts based on known facts. The longer and more desperately I tried, the more I became convinced that only the discovery of a universal formal principle could lead us to certain results*'. The trouble was that, in the individual known facts, such a universal principle did not appear, because only in the totality of the research of many scientists could it be identified, establishing relationships, bringing order, overcoming the old separation between disciplines, even sinking the research in the past centuries up to Galileo's principle of relativity. The EJA leap is enabled by the fact that there are 'certain complexes of sensory impressions that recur repeatedly'; then, sooner or later, someone feels the need to '*co-ordinate (the term used is zuordnen, associate, correlate) with them a concept [...] a kind of mental knot [...] a mental connection*'. The fact is that the scientist chooses the concept without logical necessity, in an entirely *'arbitrary manner [in the sense that] from a logical point of view this concept is not identical with the totality of sensory impressions [of level E] to which it refers, but is a free creation of the human or animal mind*'. The term creation is used in a completely anti-idealistic manner, as is demonstrated by the ending of the sentence, which demolishes an idealistic interpretation of this particular intuitive creativity; the specification '*or animal*' makes its commentator exclaim: *'another useless barrier unceremoniously removed*'. If the thinking capacity called 'mind' is a fact of organisation of matter, every living being thinks and intuits not because it has special properties, but only because all matter has a self-organising property.

Then the mysterious 'intuition', using the Einstenian conception of matter-energy-thought, is nothing other than order that is self-constituting in a deterministic chain within the E-level, which at this point reveals itself not as a fixed datum but as a dynamic in relation to time. Order, moreover, which produces ever more evident relations and utilises the most suitable thinking machine that is at that moment on the market (the unknown clerk called Einstein working in a patent office, for example), arranges its neurons, injects it with adrenalin, makes it re-discover isolated fragments of science that seemed to be without future and instead fertilise each other in a new, simple, elegant theory, liable to experimental verification. The J-shot, in scientific revolutions, is the work of the social brain accumulating at some key point. Biological intuition is an evolutionary result recorded in the genetic programme of every individual of the species; scientific intuition is an evolutionary result of the social brain, which less and less needs the individual of genius to manifest itself. That is why the evolution of mankind itself has produced its own organ - which we call the

historical party for now - far more efficient than that one and a half pounds of individual matter-energy-thinking.

Reasoning is logical continuity within the E-level of facts, which includes the old A-level of axioms; scientific intuition is the break in E; logical discontinuity (that which allows qualitative, i.e. revolutionary, change) is represented by the JA path. The logical discontinuity, however, is already contained in E: the entire system of concepts that contributes to the formation of the axioms is a man-made language; therefore, by using it to speak of language itself in the normal scientific procedure, it becomes a meta-language, it clashes against a self-reference that only the rupture of its internal logic can overcome. This is why Einstein rules out the possibility of what is normally called experimental research: '*It is a mistake to allow theoretical description to be made to depend directly on empirical statements*'. It is true that *'concepts only have meaning if we can indicate the objects to which they refer*', but in the scientific procedure they only have meaning if we can also indicate '*the scheme by which the concepts are related to these objects*'. For Einstein, the relationship between theory and sensory experience is '*analogous not to that between the broth and the ox, but to that between the cloakroom receipt and the coa*t': the broth is an 'extract', a 'concentrate' of beef; the cloakroom receipt, in the theatre, is only valid to identify, conventionally, a particular coat. A formidable slap in the face to all scientific and political immediatism.

Einstein's commentator asks why 'the continued insistence on the fundamental dualism between experience and theory, sometimes stated in unexpected and inappropriate contexts' by a great scientist of continuity and unification. This is evidently a matter of language, because we, accustomed to the slightly different form used by Marx, do not see the contradiction at all: the simultaneous and dialectical presence of rupture and continuity must be detected, since, after all, rupture occurs on the basis of a continuous accumulation of knowledge that finds its discontinuous solution in the breakthrough to the next level (and this is also the definition of catastrophe theory). But as soon as this happens, the cycle proceeds, because level A will necessarily end up being part of level E as soon as the new knowledge is shared. And it will be, since the whole process is based on material determinations.

Just as there is an infinite number of material stresses coming from level E, so, in principle, one could say that this very fact leads to infinite axioms at the higher level A. But the jump J drawn by Einstein cannot be just any jump: it is a particular momentum towards that point A and only that point, rather than towards any other solution. A history of 'boundary' conditions determines the path and its destination, all the premises are already set by previous scientific results. Without a host of other scientists, the 'Einstein genius' would be impossible. It is trivial, but the existence of a social constraint that prepares, guides and makes possible that leap and not another is generally not perceived.

Intuition, this particular human form of instinct, is the sum total of prior knowledge that explodes all at once, that utilises an individual's particular faculties and grey matter; it is certainly not the prerogative of the knowledge-creating genius as imagined by the idealists. The freedom of choice here is not that of novels, which describe invented realities (although, as Borges says, no one is given to writing something that is not already in other men's heads as well), but rather that of the crossword puzzle, in which only certain words, not others, solve the pattern by concatenating their reciprocal letters.

The axiomatic level A is thus to be considered as a new result. It becomes an indisputable fundamental reference, a 'truth' capable of influencing previous knowledge and even radically modifying it. At level A, in fact, the lines of a material, determined path are unified in a new structure of knowledge (order). The new knowledge cannot but encompass the old: if a new A is determined, then this level also explains all the facts that the previous A explained under the conditions in which that level was reached: the theory of relativity, for instance, explains all phenomena that can be explained by Newtonian mechanics (whereas the reverse does not happen). From the new level A, we can descend to understand from a new, more precise point of view, the reality E from which we started. It is true that experimental verification is needed to armour the new theory and make it unassailable to criticism, but that is not all: in a system governed by laws, the first rule, as we have seen, is that of invariance, everything collapses if a single detail turns out to be false or arbitrary.

If we now have A, then at level E there cannot but be phenomena that only with A can we discover and describe through concepts, i.e. S, S1 and S2. Let us take an example: if we assume the principle of relativity correlated with that of the constancy of the speed of light, then it necessarily follows 1) the modification of space-time, 2) the impossibility of defining simultaneity, 3) the experimentable properties of the motion of the electron. The first experimental verifications (the pregression of Mercury's perihelion, the curvature of space and light rays in the vicinity of a mass) did not prove so much that the theory was 'right', as the fact that such a theory was capable of explaining previously mysterious phenomena or of predicting the existence of unknown phenomena.

There is one detail that demonstrates the completeness of this diagram scribbled to a friend: the distance separating the S phenomena from the E level, symbolised by a dotted line, signifies the difficulty of defining an 'exact' theory. Exact predictions can be derived from wrong axioms: the geocentric astrolabes 'worked' very well as models based on that assumption, and Copernicus himself did not initiate a revolution, as is generally said, but an attempt to simplify astronomical calculations (which by the way gave no better results than the Ptolemaic ones); the Aristotelian theory of the elements was considered capable of explaining phenomena for millennia; the phlogiston theory, the caloric theory and the aether theory, which even survived the advent of modern physics, were

able to provide explanations that were considered satisfactory. Moreover, in principle, it is impossible to experimentally verify a theory since, out of an infinite number of experiments, the failure of just one would be enough to invalidate it. Finally, verification experiments very often prove what the scientist wants to prove, not because of bad faith, but because of an intrinsic characteristic of experimentation: the operator cannot not be part of the experiment.

With the complexity of all these connections, Einstein explains to us that science itself, like the matter of the universe, is not something that can be photographed once and for all in its entirety, but is a set of relations, a movement towards higher knowledge, whereby each level is subject to dialectical laws (although he never uses this term), since it contains within itself two opposites: on the one hand the fact that nothing can change simply from within the same level; on the other hand the laws of change, which cannot reveal themselves without a 'snapshot' towards the higher level. Just as the only way out of E is the leap towards A, so the only way out of A is the reverse path, back towards E by taking a new road. But, at this point, from the level of axioms, i.e. theory, the backward path affects praxis, changes it because it introduces new knowledge. This is true in everyday life, but what interests us more is that in particular historical moments - and only in those - the most advanced part of society, which we call the political party and which would basically be no more than a formal superstructure if it did not coincide with the historical movement, becomes a material force capable of provoking a qualitative change, in physical terms a change 'of state'. This reverse path represents the victory of the rational project over the law of the jungle or, as Marx and Engels point out, the assertion of the realm of freedom over that of necessity.

Before turning to the analogous scheme drawn by the 'Italian' Communist Left to indicate the passage from the realm of natural determinations to that of consciousness (will, project), we will briefly analyse another scheme referable to the same set of concepts. This is useful not only to understand the connections over time between the various attempts to settle the theory-praxis question, but also to demonstrate how humanity poses problems that arise from the entire historical process and thus, materially, cannot do without producing individual brains that behave like cells of a social brain.

It should be clear that this collective brain, now also identified by some bourgeois scientists, exceeds the critical mass of neurons and connections available to the individual and produces a higher level of processing; the individual will be more and more limited in relation to the whole and the global information will be less and less assimilable for him in its completeness. Only a social organ will be able to connect the individual brains and make them function like the cells of the biological brain: it may be by chance, but mankind, by developing the whole of communication, from the railways to the Internet (a

communication network that must be seen as a single complex even if for now it has an insignificant autonomous intelligence), is already producing the structures congenial to such a social organ before it even takes 'political' form.

The scheme we want to talk about is by Gregory Bateson, a scientist (anthropologist, cybernetician, epistemologist, psychiatrist, etc.) who tried throughout his life to relate human knowledge into a global system. Investigating the formation of knowledge and its transmission, he too realised that humans are accustomed to reasoning on the basis of an inductive process, i.e. to argue from the data of perceivable reality and, based on them, to formulate hypotheses. In this way, without linking the data drawn from reality with all the deductive knowledge accumulated in science, it is as if men take a photograph of the situation and put it in a drawer without knowing how to do more than name it and classify it with others. Thus, Bateson also draws a diagram (fig. 3) where a first level is represented by the set of objective facts. It should be noted that in any investigative activity, the data, however, are not so 'objective'; when we observe them, they are already, for that reason alone, always recorded, collected, described, interpreted, stored, selected, translated, etc.

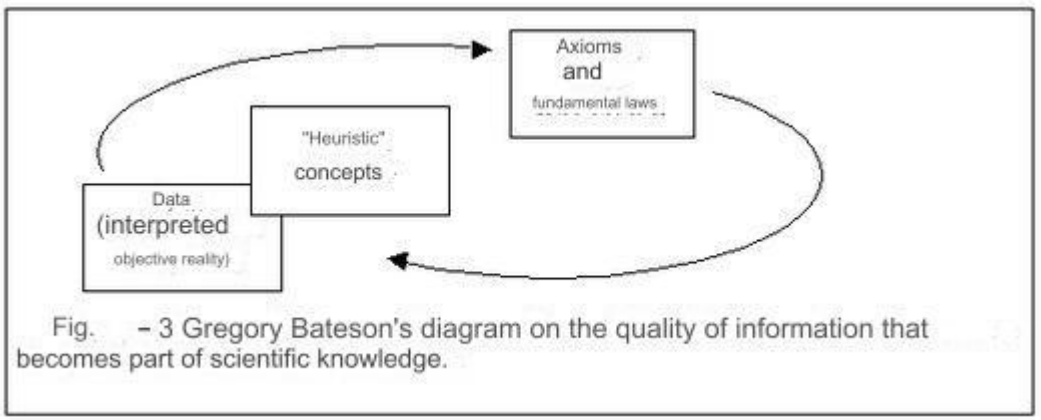


Fig. – 3 Gregory Bateson's diagram on the quality of information that becomes part of scientific knowledge.

To the 'objective' data perceived and catalogued by their names corresponds a second level of knowledge, that of language, which serves to describe relations between objects, for example words such as 'ego', 'anxiety', 'instinct', 'purpose', 'mind', 'self', 'intelligence', 'stupidity', 'maturity', and many others that in themselves have no scientific meaning unless they are related to something else. This second level is called by Bateson the level of heuristic concepts, and he adds: 'out of sheer politeness'. In fact, to tell the truth, such concepts have nothing heuristic about them, i.e. they do not represent a procedure for knowing, but suppositions of knowledge that are given a vague name, and are so debatable "*that their mixture generates a kind of intellectual fog that contributes greatly to retarding the progress of science*".

A third level is constituted by the groups of axioms that form the so-called fundamental principles, like those of mathematics, if one is also careful here not to turn them into vague propositions of the second level: '*If numbers are defined in a suitable way, and if the operation of addition is defined in a suitable way, then 5 + 7 = 12*'. Also in this third level, there are finally propositions that are 'scientifically true', but hardly assimilable to the axioms of mathematics (with which it is in any case difficult to draw a clear boundary): the laws of conservation of mass and energy, the second law of thermodynamics, and so on.

If we want a practical example of what Bateson means, we can look at the analytical index of any essay: it will easily contain both the objective data of the first level and the axioms of the third, but it will be impossible to include the so-called heuristic concepts, i.e. descriptive words, opinions, etc. Even in a scientific book (and often precisely because it is a scientific book), the proportion of words with certain meaning compared to the remaining thousands, those that generally give rise to debate, is insignificant.

Only on the basis of a close relationship between the levels just described is it possible to derive further information from them: the 'explanation' consists in the correlation between empirical data and the axiomatic level, '*but the ultimate goal of science is the increase of fundamental knowledge*', i.e., as in Einstein's scheme, the 'snapshot' that produces permanent changes at this level, increasing its internal order. Instead, in their research, scientists almost always rely on the observation of the first level, that of data, trying to explain it with the second, that of heuristic concepts, in the hope that the latter will eventually self-contribute to improving their descriptive capacity and lose their vacuity. This, however, does not happen in reality and, says Bateson, for half a century (it was 1971) '*work to which thousands of intelligent men have contributed has produced, indeed, a rich harvest of several hundred heuristic concepts, but, alas, perhaps not a single principle worthy of inclusion in the list of fundamental principles*'.

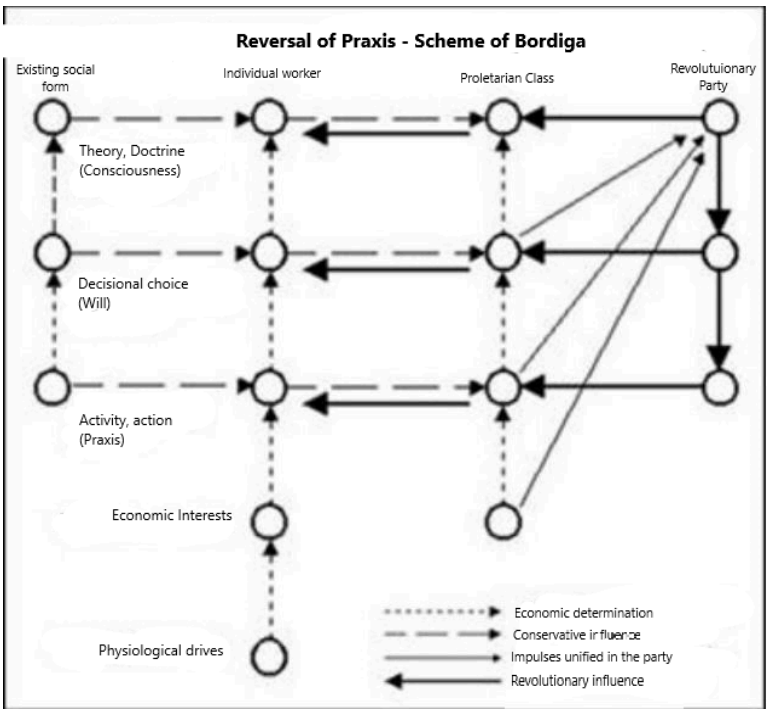
Galileo, Marx, Einstein, Bordiga, Bateson: names that evoke works distant in time and space but which represent a real continuity, which can be integrated with who knows how many other references. This continuity certainly does not present itself in a declared manner, but is to be sought by us following a unifying thread. It will certainly allow us to prove correct the hypothesis that a longer sequence exists, and our examples can be expanded in number and quality. After all, this is also what we have undertaken to do with our work. We do not care if Einstein was a democratic moralist and Bateson an eclectic with very unsystematic knowledge (but this also depends on the criterion of 'classification'). After all, only certain superficial philosophical criticism places Marx among the 'creators of systems'; in reality, Marx and Engels felt dominated by the communist demon as organic to a whole greater than the mere sum of its

parts, just look at how they dealt with the scientific issues of their time: evolution, geology, mathematics, physics, etc.

The schemes we have considered, from Galileo to Bateson, have in common the necessary link with objective reality, but in the knowledge that this is always interpreted by scientists, who use very subjective and above all traditional, established criteria in describing it. Only with the integration of the levels is it possible to make the leap to A, the theoretical one, and from there to descend an action that visibly influences praxis according to desired ends.

The programme (represented by A) defines in advance the sequences of operations to be performed (the level S, S1, S2) in order to obtain expected results. In physics, once the fundamental postulate has been formulated, the consequence follows that, given prior conditions, certain phenomena must be found in succession; if this does not happen, the whole theory is lost. It is interesting to note that even in chaotic systems, indeterminacy derives only from the statistical impossibility of prediction, whereas the emergence of a describable order is established. Similarly, it must be possible for social science to define in advance not only the end result, but also the path, the modalities to reach it; at the limit, to verify laws that establish the emergence of a certain order from chaos. This is why the modalities in S cannot be just any modalities: a possible S3 phenomenon cannot be 'chosen at random'; it will be 'decided on the basis of...', and its in-depth knowledge will have to proceed not from phrases, i.e. heuristic criteria (let's call them 'out of courtesy' like that), but from already established principles.

The diagram of the reversal of praxis (fig. 4) may appear dissimilar to Einstein's and Bateson's diagrams, as applied to social facts; but, observing them without preconceptions, it becomes clear that they are all based on the same principles and are therefore integrated with each other.




Let us begin the comparison between 'our' diagram and Einstein's: the physiological drives, economic interests and current practice, represent level E of the 'chaotic variety of sensory experience'. The snapshot corresponding to trajectory J is given by the arrows that start from the class and ascend, through the different levels of material drives (physiological, economic, social), to the party, which in the Left's description represents the collective brain, axiomatic level A in Einstein's description. The arrows highlighted in bold, which return in the opposite direction towards the 'facts' (praxis), represent consciousness, i.e. the decision, the will, the project to which the individual and the class, previously involved in chaotic and dissipative directions, now actively collaborate by directing a real force towards the same goal.

Looking again at our scheme, starting from the left, we have the 'data' that corresponds to those described by Bateson, represented by the level of the existing order, variously interpreted as regards both the individual and the class, where 'heuristic concepts' are cultivated, i.e. words that express opinions on the beautiful and the ugly, on good and evil, in short, on everything that can be interpreted, before the need to go further. This is 'politics', where photographers of concrete situations wallow, where discussion can be eternal without leading to any result. Only through the further level, represented by the last column on the right, that of theory and party, can a solution to the insoluble problem of chatter in which everyone is 'right' or 'wrong', a bit like in barroom discussions, arise.

Some might ask where they see, here, the practical indications that could be used to guide the activities of thousands of militants widely scattered around the world; to avoid mistakes, which there must be if the situation is so dire; to 'start building' the party; to better understand the various tactical issues; in short, to realise all that is enclosed in S and that at first glance does not seem to

promise exhaustive answers. Of course, the scheme of the dialectical overthrow of praxis may also have its immediate readers: given the conditions, only the 'overthrowing' element is missing, the revolutionary leadership is missing, so let us build the party.

We have some experience of such arguments and know that they are mostly voluntarist nonsense. However, within the bounds of the attempt to delve deeper, the question of how the physical entity of overthrow is formed and developed, should not be treated with arrogance, even though it has in itself the defect of already presupposing a capacity for ideological overthrow of praxis, for the application of will on the part of the individual, who must overcome the current way of thinking. That is why one must tackle the problem without heeding those characters who, imagining they can overthrow praxis on their own account, are convinced that by their own and others' will they can radically change things, can even revolutionise the whole of society. And of course they strive for this. Now, one can certainly apply sufficient willpower to DIY, tidying up the bookcase, whitewashing the kitchen, but one must realise that, when it comes to social facts, the problem becomes immensely more complex.

In any case, when the social movement stagnates, almost everyone lives in the belief that society is more or less immutable, technical progress aside. Each individual is one social particle among billions and contributes to the historical becoming for what it is, an almost nil fraction, all the more so - since individual drives can be conflicting, and thus cancel each other out. Only a social polarisation can unify the chaotic drives into a concentrated, directed power capable of counteracting that of the dominant ideology and unleashing concrete effects towards change. But this polarisation depends on factors alien to the will of individuals, namely the time of accumulation of the contradictions inherent in the old mode of production, which is also linked to the time of exposure of men to the effects of counter-revolution, i.e. to ever deeper ideological corruption. As long as polarisation does not occur, it is difficult to go beyond the level of phrases and enter the level of schemas, which are then the first level of knowledge for the - let us say - planning activity of the party.

So the question, generalised today, about the infamous "what to do?", about how to form and develop the physical force that will lead the overthrow of praxis and act materially in the direction of change, proves in itself that such a process is not taking place. If there is demand, there is no polarisation; there is no understanding of the problem either (Lenin, as we have said a thousand times, did not ask, he explained).

The possibility of understanding on the part of the individual does not arise within the individual itself, just as in Einstein's scheme nothing new arises from AND on the basis of its contents alone. In the original text of the scheme for the reversal of praxis, we find described the dialectical relationship between

the opposite directions of the arrows of influence (conservative and revolutionary): the revolutionary party can only be a conscious factor of decision, capable of influencing events, insofar as it is a product of them (the terms are to be understood in a mathematical sense: ab = c means that c is the product of the multiplication between the factors a and b; c can in turn become, but only after multiplication, a factor that determines another product).

It is in the events that have matured over time that we find the conflict between the old forms of production and the new ones, the ones that we can already see emerging from the explosion of productive forces. Therefore, the individual will only be able to understand the dynamics of the formation of the party and its development to the overthrow of praxis if this material conflict involves him to the point of projecting him onto line J, which represents the spurt of knowledge and thus of action towards S. But it is not in his brain that this will happen, but outside it, and he as an individual will not be granted a priori awareness of the new praxis, because it will come to him from the party, through the many who, like him, will give it substance.

We refer to Marx and often to those who came after him, even when, like the scientists we have used here, they are not 'Marxists'. We do so because they represent the human material that prepares the historical leaps, even though very few have succeeded in giving global accommodation to the problems addressed, maintaining coherence even at the level of social conception. We use not isolated fragments but a continuous accumulation, a dynamic proceeding of history in which the last two classes prepare a decisive clash for humanity. In this proceeding is acquired, among the theoretical endowments of future knowledge, the final clash between knowledge due to the individual idea (illuminated perhaps by divine afflatus) and that due to the work of men in social production. In the second case, 'knowledge' is regarded as an accumulation of the species, and the sudden leaps, to which particular personalities or events may have contributed and continue to contribute, are not strokes of genius of the individual or his organisations, but the results of profound historical ruptures, in which the relations between classes and the mode of production are disrupted from the foundations.

**Recommended readings**


- Albert Einstein, *Correspondence with Michele Besso* , Editors' Guide; *Autobiography scientific* , Boringhieri; *As I See the World* , Newton Compton; *Thoughts of the difficult years* , Boringhieri.
- Gerald Holton, *The scientific imagination* , Einaudi.
- Gregory Bateson, "The Science of Mind and Order", introduction to *For an ecology of mind* , Adelphi.

- International Communist Party, "Marxist scheme of reversal of praxis", in *Party and class* , available in ours Quaderni Internazionalisti series; "Relativity and determinism", *Il communist program* no. 9 of 1955.