

CRISIS OF SCIENCE (OR OF "SCIENTISM") IN MODERN CULTURE AND SOCIETY ?

From its origins Science gave rise to a different or better antithetic evaluation from the public of uniaformed people and also from the public of cultured people (this part of cultured people who was not scientists, of course) : on one hand the scientific activity, its discoveries, its appliances were considered something very similar (anyhow very close) to "magic" ; something - to make clear the meaning of my words - capable of giving to men the cleverness of mastering or of counterbattering the strength of nature ; in short, the possibility to achieve goals until a certain time absolutely forbidden to mankind ; on the other hand, Science was considered as a devilish plot to avoid or as a useless thing (a purely vain attempt to know the truth which only the pure intelligence absolutely free of the "slavery of the senses" was able to reach) or at least as a simple instrument which man can use, but must neglect after use. And more than that, during various centuries, some people denied Science the right to exist as a cultural factor of progress and of mankind's emancipation. There was also somebody who reproved Science and scientists as negative factors to be opposed and destroyed to make possible to the so-called "supreme human and spiritual values" to emerge again on antithesis to the achievements of Science considered abasing.

To let this be quite clear, I think suitable to go back to the origins of history of Science and to see how, when and why originated this new way of observing and analyzing the reality of physical world and its laws.

Science - as everybody knows - has a precise birth-certificate and the names of its creators are equally unequivocal. Modern Science - or scientific methodology - originated by Galileo Galilei even if before him and during his time other people had same intuition and enforced (at least partially) his experimental method. But we can say that Science originated by Galileo because only he codified its methodology and enforced it on a vast scale to every kind of research

garding the phenomena of nature. The phenomena are observed ; anal-
 d on mathematical basis ; a hypothesis of work or a theory foreseeing
 e nature of the subsequent phenomena is built up ; then we verify by
 perience if these phenomena act according to the hypothesis or in a
 fferent way. So "provando e riprovando" (trying, testing and proving) it
 possible to establish on experimental basis if our theories coincide
 not, with the experimental reality.

In the first case it means that the hypotheses are sound (and sound
 ey will stay until having proof to the contrary) ; in the second case
 means that our theories were not right and therefore we must change ^{them} _^.

In fact, scientifically speaking, the most important things are
 e results and not the theories ; it is just for this reason that the
 mous french mathematician Henri Poincaré, at the end of the last
 ntury defined Science "the cemetery of the hypothesis". This is also
 e reason why in the scientific research never had been and never can
 regress, because if one hypothesis or one theory does not fit or fits
 til a certain point, we can throw it peacefully away and we proceed
 eating another hypothesis or another theory, until we will find that
 e, which exactly coincides (or is the nearest) with the experimental data.

We can say in short that Science is a continuous renewal, depending
 so on the improving of research means. Nothing is unchangeable. In
 ience there is no place for dogmas. Of course there are phenomena
 ich - however many tests we do - act always in the same way and for
 is reason they are "definited" states, "principles" and "laws" univer-
 lly valid; but they also - please pay attention to that - will remain
 ie just until the experience will demonstrate they are true. We had the
 st clamorous example of that at the beginning of the present century
 n the theory of relativity pointed out the limits of Newton's physics,
 l the quantum phenomena made the same for the undulatory theory.

When it happened many people said and wrote that "Science was denying itself" nearly as always happens in the world of philosophy where each system refuses the previous system. People said and wrote that relativity "unhinged" the magnificent newtonian construction. Nothing of that happened ; if Science would have been considered for what it is, such non-sense would not be heard. In fact Einstein or Planck, Born or Schroedinger unhinged a mere nothing ; they simply demonstrated - using the experimental system - that some phenomena were not corresponding to theories of so-called classical physics. Newton accepted the postulate of the "absolute time" . Einstein-
 considering the experimental demonstration that the speed of light is invariable replaced the conception of absolute time with that of the constance of the speed of light , and demonstrated the non-existence of ether, whose presence had been invoked by many people to explain the behaviour of many phenomena. Carrying on their re-

35 Einstein's theories coincided with reality. In brief - to make it clear by a practical example - if we would think ourselves capable of constructing an accelerator machine for nuclear particles (from the more simple cyclotron to the more complicated and powerful protosyncroton) basing ourselves on the Newtonian physics, our machines could not be constructed neither could work. In these circumstances it is necessary to use the relativistic systems. In other words certain parts of Newton's physics are of use until when the considered phenomena don't act in the field of speeds near by those of light and in the ambit of nuclear particles. The classical physics with its laws remain valid in all the phenomenology widely demonstrated during three centuries of research and experiments. If somebody would like to have an example could go to collide with another car and he will be able to prove at his expense that the Newtonian law which connects the force to the mass and to the acceleration is quite corresponding to reality.

All these things tell us that the new physical and physical mathematical theories created by Einstein and by his successors are valid and will remain valid until we have proof to the contrary. If tomorrow Einsteinian physics will demonstrate itself not corresponding to reality, nothing serious will happen; Einstein's theories will be replaced by a more suitable and new hypothesis, new theoretical speculations will be made.

It's all.

But let us go back to the times when Science was born.

As above mentioned, before Galileo many scholars already understood that it was possible to investigate, to analyse, to interpret, to get acquainted with the phenomena of nature only by the experience and by the language of mathematics. Such ideas appeared both in West and in the East. Even if the events concerning this part of the world are less known. For instance, it is extremely interesting studying the history of Science, to notice how certain developments of the human mind have been analogous and contemporaneous, although there were no contacts.

This is the case, for example, of the Japanese Alchemia (and saying Alchemia we mean what it was really, in other words a prodrome to Chemistry and not a medley of magic-ritual operations). Well, between the identical alchemia which migrated to Europe with the Arabian conquests in the early Middle Ages and the Japanese Alchemia which was born and developed itself on the Japanese islands in absolutely independent way, resemblances, knowledges, achievements, results are extraordinarily similar or in some case equal.

We can observe the same thing in the field of research regarding physical phenomena (for example magnetism and its consequent appearance to the compass) and so on.

But let us remain a little bit in the times of the origins of Science of its father, our dear friend Galileo.

We mentioned above that many scholars before him both in West and in East already thought necessary to study the phenomena of nature by the experience and by the language of mathematics ; but only Galileo gave to these ideas an organic settlement and deduced from it the methodology that also nowadays we use and that represents the essential distinctive feature which marks Science as different, among all other purely human speculative activities.

When the scientific method came to light and started to grow up, the Western culture broke for the first time very badly and we cannot certainly charge Galileo or his successors with that. They already told very clearly that their method of research was suitable only for the phenomena of nature ; and more than that, they indicated in the ambit of these phenomena a particular field of determination - according to the leading expression that Schroedinger invented nearly three centuries after.

35 The first break and the consequent crisis of culture occurred because the catholic philosophers and theologians thought that the new disciplines which were not supported by the religious and philosophical dogmas mined the foundation of their own learning. The new system held in low esteem the "IPSE DIXIT" , the quotation used to indicate Aristotele's power, but had as supreme inappellable judge the results of experience and their mathematical interpretation. From here started the battles and the condemnations against Science ; from here started the denial to the experimental Science of its cognitive value and its reduction in to a merely utilitarian factor ; from here started the most deep present crisis of the modern culture.

It is long since Galileo and his followers were condemned and we can now say, according to the historical criticism demonstrations, that it occurred not only because - as the judgment said - Galileo was a supporter of the Copernican system, but especially because he was the creator of this new form of knowledge.

From this time on, the scholars of Theology and Philosophy realized that Science, Philosophy, Theology act in different fields. They realized that Bible, Koran and the sacred texts of Buddha's Brahma's religions cannot be supported or contested by the scientific discoveries.

We cannot ask the proof of the existence or of non-existence of a god on the basis of the experimental Science, at least until when will be possible to transfer this god to a test-tube and to measure it with a manometer, in other words until when these supernatural entities will become an occurrence of nature in which "πάντα μέτρον ἢ ἀριθμῶν καὶ σταθμῶν" , everything is measurement, number, weight, that Science investigates and finds in its researchs.

Once made clear which field belongs to the different activities Philosophy, Theology and Science, persecutions and condemnations stopped, also because the historical and political conditions of mankind changed, but did not stop a certain hostile attitude on considering the scientific activity.

Somebody regards Science as something absolutely devoid of a real cognitive value and relegates it to a merely instrumental function ; somebody else, on the opposite side, ascribes to Science values and capabilities that it neither has nor could have ; in other words, the scientific activity and its applications have been considered as the panacea for all the human ills and troubles. And so we come to the positivism of the past century and to the new-scientism of nowadays from which a certain crisis of the modern culture takes origin.

How many times ^{have} we heard or read sentences like this one: "If we can go to the Moon using the knowledge obtained by his Science, he can do the same for solving the racial problem, the problem of hunger, the problem of ignorance, the tragedy of the so-called third world !"

It is not necessary to spend a lot of words to demonstrate that

such a mental habitus is the result of an unbelievable confusion of ideas. People who tell things like that mix up Science with its applications ; the field of phenomena of nature on its whole with the field of political, moral, social human activities ; the applications of the scientific discoveries, directed and utilized in one sense instead of in another, can give a good help to many human problems, but they cannot absolutely be the fulcrum of the solution itself.

If the human soul remains selfish ; if a group of men maintains an aggressive charge against other groups ; if the attacked people revolt and go beyond right measure on its claims of revenge and counter-balances an injustice with another unfairness, what Science do, if it is true - as it is true - that Science is only a system to get acquainted with the secret laws of nature ?

35 But there is another attitude which charges Science with performing negative and harmful works towards men. It is said : the knowledge that scientists place at mankind's disposal are too great and too dangerous to men, because men are not prepared to make use properly of the instruments which Science gives them. And is quoted the already classical example of the atomic bomb (this meeting takes place in Japan, so we don't need to talk about its noxious consequences) and also the example of the awful possibilities that a dictator could have at hand, when the conquests of molecular biology and of modern genetics will turn - as it seems achievable - into operations of "genetic engineering"; in other words if tomorrow^{it} will be possible to modify the genes which preside at the transmission of hereditary characters to obtain generations of slaves or of rulers, of entirely dominated fatigued men, or of superintelligent men.

It is quoted also the ecological failure that is told to be originated from Science, and from Science, and from technology, which is its offspring.

Once again, there is a confusion between Science and its application

tween instruments and cognitive activity. It is necessary to come
 an understanding : is Science - as the non-scientists from Galileo
 wards always asserted - a mere instrument, it cannot be charged
 th anything ; it would be really absurd that a mechanic charges
 s pliers and not himself with breaking a bolt that he is tightening?
 , on the contrary, people recognize to Science the dignity of its
 gh cognitive value so instructive as the philosophical one, of the
 ral one, of the historical one, then it makes sense to hold the
 ientists responsible for using the instruments produced by Science.

But saying that we exalt the hazard of the technocracy, forgetting
 at also it - at least in the worse sense - represents the worst use
 the pseudouse of the advantages produced by Science.

Now we must make another comment. Science and scientists in toto
 e charged with being responsible for the bad use of the products of
 ience ; but who made this bad use and still are making it are the
 liticians (almost never coming from the rows of scientists) ;
 twithstanding that, it did not even cross somebody's mind to charge
 rtain philosophies with the troubles they gave to mankind. Let
 think about Nietzsche and the nazism ; let us think about Marx and
 e communism, at least for what it represents on the negation of some
 adamental human liberties and moreover it is not a case that at
 esent days just one of the most important living ^{physicists} Chacarov,
 in serious troubles because there is somebody which claims to sentence
 him to silence.

On its part, the scientific activity due to the necessity to
 etrate always more deeply in the problems it is dealing with, split
 on thousands and thousands of specializations and molded languages
 diversified that it is often impossible to understand, not only for
 t connected people, but also for scholars of the same discipline
 ting in different branches.

We lost the completeness of the general view ; we forgot the

interdisciplinarity, (the relationship of various disciplines), and for this reason sometimes there are time-lags or difficulties in applying in one field the discoveries and the acquisitions obtained in another.

At this point the gap between the so-called humanistic culture and the scientific culture becomes enormous if not insuperable. Here is the "two cultures dichotomy" so clearly illustrated by Charles Snow; here are the incommunicability and the incomprehension between Science and philosophy and among all the different things that can be indicated with these two terms.

In the last times these problems were widely discussed and it is already a good symptom : ways and methods to get out of the present crisis of culture were suggested ; it was recognized both by scientists and by humanists that the human intelligence is not made on separate boxes (one for mathematics ; one for physics ; one for chemistry ; one for music ; one for philosophy ; one for poetry, and so on) ; from it came the stimulus to the interdisciplinarity, to the interexchange of information , to the use of an intelligible language.

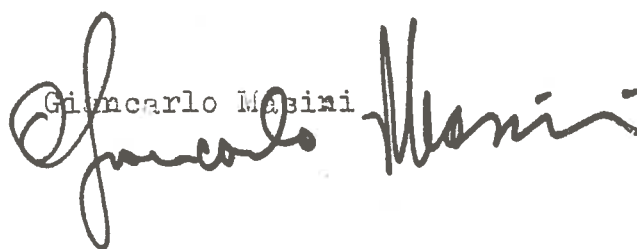
It is possible to achieve the goal of suturing these two worlds of culture and this meeting is proving it and it is foreboding of immeasurable results.

Modern man eventually understood that it is necessary to act in the unity of knowledge. With that, we are not saying that the ^{physicist} physician must become a philosopher, or vice-versa the poet must become a chemist, but it is a way in order that they understand each other. The popularization ^(of science) can be a really valid method ; we can say the same for the historical research, whether concerning Science or concerning the developments achieved by the human mind ; experimental Science and "human sciences" can and must proceed at the same rate. Regarding Science, we can say that crisis is only for the scientism, considered in the sense we

poke about ; for all other aspects of the human knowledge we had important and fundamental indications during the present conference.

The two terms of the human culture (the scientific one regarding the phenomena of nature and the philosophical one regarding the human spirit and its moral, political and social manifestations) must keep together and converge toward a ^{or cultural science.} science for man, with all its material and spiritual benefits : such it was, to sum up, the ideal of the Renaissance : a knowledge which was conscious of the finest possibilities, of the dreadful positive qualities of the human mind but which was also conscious of its deficiencies, of its problems, of its troubles, in one word of all its negative aspects.

This is in my opinion - as I tried to demonstrate in my books on history of scientific evolution in various disciplines (from mathematics to physics ; from astronomy to astronautics ; from biology to chemistry) , the most true and useful meaning of the effort that we are going to give moral value to modern Science in a spiritual embrace of unity of the Sciences : this is actually the title of our meeting.

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