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Salvo D'Agostino (Italy)

FEDERIGO ENRIQUES (1871—1946) AND HISTORY OF SCIENCE IN ITALY IN THE PRE-WAR YEARS

A panoramic view of Italian culture and society in the prewar years is a pre-requisite for an appraisal of Federigo Enriques' life and work.

The Italian cultural scenery from 1900 to the thirties has been recently analysed from different angles,¹ and various reasons have been found for that sort of backwardness which seemed to characterize this scenery in comparison with the then other leading European countries. It is my opinion that, concerning Italian science and culture in that period, one of the key aspects of the Italian panorama was the absence of interdisciplinary cross-fertilization between sciences and technology, on one side, and science and philosophy, on the other.

It is known² that this double cross-fertilization had played a fruitful role primarily in Germany at the turn of the century, promoting researches through financial support and stimulating fresh approaches to scientific problems. In fact this aspect did not pass unnoticed among the more distinguished representatives of Italian science: Vita Volterra (1860—1940), one of the major Italian contributors to mathematical physics in the pre-Fascist period, intended to react to the situation, founding in 1907 the Società Italiana per il Progresso della Scienza, with the aims both to improve collaboration among specialists and to encourage diffusion of science at large.

Like Poincaré, Volterra was not favourably inclined, until 1922, towards Einstein's *Relativity*, considered by him "a simple formal variation of Lorentz's theory". In 1922 however, especially after the impressive astronomical confirmation of the general theory, he changed his opinion.

It is interesting to remark how different were Enriques' (and Guido Castelnuovo's) reactions to Einstein's theories during the same period. Relativity

¹ Micheli, 1980; Reeves, 1984; Maiocchi, 1985.

² Beyrchen, 1981.

was in fact congenial to Enriques' conception of a unification of mathematics and physics into a geometry of space-time, capable of unifying both classical and relativistic theories.

On the contrary, Volterra's adhesion to conventionalism did not favour his appreciation of the novelties of Einstein's relativity, encouraging his equidistance between what he considered the strategies of conventionally equivalent theories (i.e., Einstein's and Poincaré theories).

These are just a few notes to illustrate the peculiar situation in Italy and especially the fact that the cultural debate on science was in that period mainly supported by mathematicians and mathematical physicists.

Regarding physicists, they were remarkably absent from this cultural debate, though they were not completely absent from the international physical research stage.

Italian physical research, though hampered as it was by scarce financial government and industrial support, had been brilliantly represented by Augusto Righi's works (1850—1921) and also by the Macaluso-Corbino discoveries and Stark-LoSurdo Effects. However, this situation was not in the least comparable to that of other European countries. The fact was that Italian physics was suffering, among other things, especially for the absence of a flourishing school of theoretical physics.

Apart from sporadic contributions by Mario Orso Corbino, Antonio Garbasso and Augusto Occhialini in 1913—1914, the new quantum theories were almost unknown in Italy. In some cases they were received with diffidence, because of a widespread inertia in abandoning well established concepts and practices. Perhaps a sort of second-hand positivism, accompanied by a widespread lack of epistemological interests which characterized Italian 19th century science, also had negative influence on the physicists of that period. Corbino declared in 1907 that the postulate of Relativity was "a metaphysical prejudice", and in 1911 Righi considered the electromagnetic ether "an irreplaceable concept", remaining faithful to this view till his death in 1921.

This situation changed after the First World War, especially when *General Relativity* had received experimental confirmations and Levi-Civita collaborated with Einstein for the mathematics of the general theory.³

Another remarkable characteristic of the Italian scene was the absence of contacts and conceptual exchange between scientists and philosophers. The mathematical physicists considered themselves heirs of the great 19th century tradition, which they wanted to pursue with a rather conservative outlook. Experimentalists, on the other hand, were prisoners in the narrow perspective of a second-hand positivism. Philosophers were also heirs of a humanistic tradition, recently warmed up by neo-idealism, which in the tens and twenties was represented by the outstanding works of Benedetto Croce and Giovanni Gentile.

³ Maiocchi, 1985.

In this situation Enriques is the bearer of a particular culture and mentality different from that of the great majority of the university professors and men of culture. Among others, this was one of the difficulties he met in developing his program. Enriques studied in Pisa at the celebrated Scuola Normale Superiore, where he graduated (laurea), at twenty in 1891. His teachers were Betti, Dini, Volterra, Bianchi and Cremona. At the age of twenty-five he was nominated Professor of Geometry at the Bologna University, at the time regarded as the center for science and culture, full of personalities such as Righi and Murri. The twenty-eight years he spent in Bologna were his most fruitful years for research and cultural activity. He created, in collaboration with Guido Castelnuovo and Francesco Severi, the field of algebraic geometry, thus introducing Italian research in the international forum. Some of his contributions to differential geometry, are today considered classical ones.

He published *Problemi della Scienza*, in which his views are related to the great currents of European epistemology, and *Questioni riguardanti le Matematiche Elementari*, aimed at the diffusion of a modern mathematical culture among secondary school teachers. For the same purpose he founded *Scienta, Rivista di Scienza*, a journal devoted to interdisciplinary research and scientific synthesis.⁴

In 1922 he was called to the University of Rome and there he continued his cultural program, increasing the emphasis on his epistemological and cultural interests, founding a Graduate School in History of Science and training a group of historians of science; Attilio Frajese, one of his students, collaborated with him on researches on ancient mathematics and pursued original work of his own.

In the thirties, Enriques gave his major attention to Philosophy and History of Science.⁵ His works were published in France, because in Italy he was now disliked by the Regime. Therefore, he felt that in the neighbouring country his contributions could reach a larger and more interested audience and be better appreciated.

Of the three works published in France, *La Signification de l'Histoire de la Pensée Scientifique* (1932, Hermann, Paris), *La Theorie de la Connaissance Scientifique de Kant à Nos Jours* (1938, Hermann, Paris), and *Causalité et Déterminisme dans la Philosophie et l'Histoire des Sciences*, (1941, Hermann, Paris), the one that deserves our attention is the first one.

In this small publication he illustrates his view on the scientific enterprise as a never ending process, an effort to subdue to reason an overgrowing portion of reality. Science is not a definitive "system of truths", a "static and complete sytem" of facts, laws and theories, but its meaning resides in their interaction and reciprocal coordination within a neverending growth-process.

This growth-process consists in breaking off the logical structure of

⁴ Lombardo Radice, 1938.

⁵ Enriques, 1936, pp. 7ff.

postulates and theories, as caused by the increased weight of experimental evidence. This view justifies Enriques' belief that history of science is an essential component of science itself.

The historian's aims are the elucidation of the features of this process and the rational justification of the reasons for the changing of old postulates. However, this change, according to Enriques, occurs within a continuous process of conceptual deepening and clarification.⁶

Enriques' continuistic philosophy, though enlarging his cultural perspective and stimulating critical approaches to history of science, played, on the other hand, a stiffening influence, hiding what in the new theories was essentially original and unprecedented.

This was the case concerning the reaction of Enriques to Einstein's *Relativity*, which he welcomed as a coherent development of the space-time description of events, in the stream of classical physics, going back perhaps to ancient Greece, but which he did not consider worthy of his interests and efforts in order to deepen its meaning and defend it from many of his colleague's attacks.⁷

Although opposing Idealism and Pragmatism, Enriques recognised some of their merits, as for instance their evaluations of links between science and other philosophical, religious, economical and social manifestations of culture.

With regard to problems which are still the focus of present debate, e.g., the difficulty in putting rigid boundaries between internal and external historiographies (in our modern terminology), Enriques rejects the extreme externalist pretention of reducing the rich dynamics of science to simply economical or social factors. He rather emphasizes that the influence, if any, would act in the opposite direction, i.e., from science to both culture and political action. His favorite examples regarding this matter are the Enlightenment and the French Revolution, both inspired by the rationalistic faith in an objective truth possessed by everybody, independently of historically conditioned personal experience.⁸ He recognizes that psychological and unconscious factors (emotional components of personality) have non-negligible role in intellectual processes, and he struggles to seek a reconciliation between this evaluation and the classical ideal of reason, as an activity free, par excellence, from emotions.

He finds that this reconciliation requires a widening of the idea of reason, in order to create a space for the historical dimension of experience. The radicalism of his conception can perhaps be better grasped by following his parallelism between this reconciliation and the synthesis between rationalism and empiricism, which Kant had acknowledged in the very theory and practice of science.⁹

⁶ Enriques, 1936, pp. 12ff. and pp. 63ff.

⁷ Maiocchi, 1985, pp. 79ff.

⁸ Enriques, 1936, pp. 40ff.

⁹ Enriques, 1936, pp. 41ff.

The appreciation of the historical dimension of science is for him an essential aspect of modern cultural development. I think that there is no need to underline the modernity of some of Enriques' views, being part of our present debate.

A characteristic of Enriques' epistemology is a sustained evaluation of the dynamical features of science—the modality of the growth process—and, conversely, a scarce attention and indifference for the analysis of the structural features of theories, their axiomatic inner logic. Similarly, he was indifferent to the neo-empiricist philosophy because its interests are “limited to the logical reconstruction of theories as such” and to the analysis of what are considered non-meaningless questions.

Even from these few notes it should be clear how Enriques' views anticipate some of the present time topics in historiography of science. His indifference to mathematical logic and Peano's work, which some of his recent biographers¹⁰ regard as the ‘capital sins of Enriques' epistemology, is consistent with the rest of his views, and specifically with the mentioned evaluation of the dynamical aspects of the growth of science.

When in 1922 Enriques was appointed to the University of Rome, a period of Italian culture came to an end, as a consequence of the First World War and of its economical and social effects. The rise of Fascism and its more or less indirect influence on Italian university life and culture were the other main events.

The post-war period brought into the Italian small industrial citadel, and into government circles as well, a certain interest for applied research. The “Consiglio Nazionale delle Ricerche” was founded in 1928. At the same time Corbino, Fermi's mentor in the University of Rome, succeeded in convincing the Fascist regime of the possibility that fundamental research in physics could represent a good investment for the future of both the Nation and the Regime. Official culture either ignored or considered with some suspicion the more philosophical aspects of science.

At the beginning of the thirties, Fascism began to leave its marks on the Italian universities. In 1930 professors were requested to swear an oath of loyalty to the Regime and their refusal to comply with the Regime's impositions caused them to be fired from their positions. As a result Volterra and Giorgi lost their positions.

In 1938 the anti-Hebrew racial legislation removed the most brilliant representatives of Italian culture from the University chairs and Enriques was one of them.

In the thirties he had worked in some isolation with respect to the new trends in Italy's scientific panorama. His passionate polemics against the neo-idealistic philosophy of Croce and Gentile, on the one hand, and the conventionalistic philosophy of some of his scientific colleagues on the other,

¹⁰ Giorello, 1977.

were now addressed to adversaries whose cultural presence had, in effect, vanished or, at least, rapidly declined.

Croce's influence was in fact marginal in the Fascist Regime in the thirties and, as to Gentile, he sought and obtained an alliance with the Regime, modifying somehow his philosophical and political views. Gentile had also been the major inspirer of the School Reform (1922—1923). Enriques' reaction to the Reform was an ambivalent one: he approved the relevance given to history and historicism in the Humanities and the emphasis on the so-called Active Pedagogy in the curriculum for secondary schools, but he refused to accept the devaluation of scientific culture and of the historical and philosophical dimensions of science. They were the side effects of the Reform Program congenial with the Fascist interest in just technical and applied aspects of science. (Unfortunately this view found also some compliance in many scientific circles of the period.)

The new trends in the Philosophy of Science in Europe in that period were also contributing to Enriques' cultural isolation: a new alliance between neo-empiricism and the few philosophically minded scientists was in view. Enriques, who in the past had failed to appreciate Peano's contributions to symbolic logic, was also in these matters against the mainstream.

An episode in Enriques' life in Rome is perhaps an emblematic example of this isolation. In 1937 he tried to activate a *Seminario Fisico-Matematico* at the Institute of Mathematics of the University of Rome. Lucio Lombardo Radice, a student of Enriques in Rome and himself a brilliant mathematician and a passionate scholar in the pedagogy of mathematics, thus expresses¹¹ his recollections of a meeting at the *Seminario*:

I recall with vividness that afternoon the two groups of scientists facing each other in a crowded classroom at the ground floor of the Institute of Mathematics in Rome. I am still impressed by the difference in the turn of mind that each group was representing, a generational split between two generations of great scientists, represented on that occasion by Federigo Enriques and Enrico Fermi. I would perhaps be imprecise and unfair if I would label the two contrasting mentalities as rationalism against empiricism, scientific criticism as against pure technicality, because Enrico Fermi was also a *maitre à penser*.

It would be more proper to speak of a divergent set of interests, a different problematic presented by two generations which were representatives of two scientific epochs.

On one side Enriques' intellectual passion for the philosophical problems posed by the new development of science (a passion he shared with Guido Castelnuovo, Francesco Severi and others in his generation). On the other side Enrico Fermi's sceptical smile and the impression he gave of a limited and marginal interest in those problems, in comparison with his longing for actually doing physics.

There should be no surprise then if the almost total black-out for history of science and the racial laws convinced two of Enriques' students, Giorgio De Santillana and Aldo Mieli, to emigrate abroad.

Scarce perspectives were opened for the few historians of science who were

¹¹ Lombardo Radice, 1958, pp. 65ff.

still active in Italy at the beginning of the post-war cultural revival: Umberto Forti and Attilio Frajese, although still pursuing in private their favorite studies, decided to pursue government careers. Vasco Ronchi represented a situation of his own, as he was engaged in active optical research, from which he received fresh inspiration for his history of optics.

After the Second World War in Italy, neo-positivism (or logical empiricism) was the philosophy which gained an increasing attention among some philosophers and scientists. If an alliance was ever signed between the two groups in Italy, it happened in the context of the new ideas, which were pouring from Continental Europe and the Vienna Circle. Among the scientists, Persico, Frola and Colorni were attracted to neo-positivism because it dealt with problems closer to their usual trend of ideas and professional work.

Unfortunately for history of science, the new philosophy showed no interest in those problems which were congenial to Enriques and his school; it cultivated those fields, such as formal logic and methodology of science, which had found little audience among Italian scholars. This situation changed slowly in the fifties.¹² An initial interest in history of science came from the unexpected side of physicists and philosophers who had shown an interest in neo-empiricism and methodology of science: Ludovico Geymonat, Giovanni Polvani, Enrico Persico, the physicist who introduced Quantum Mechanics in Italy. They contributed either with their work—this is mainly the case for Geymonat and history of mathematics—or with their institutional action in the University, to help and encourage scholarship in the history of science among the new generations.

Placing their emphasis on the problems of changing theories, recent trends in scientific historiography are reviving ideas which were familiar to Enriques' mind. An attention to these aspects of his epistemology, through a detailed analysis of his contributions, is, in my opinion, a worthy task for modern scholars.

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¹² Giorello, 1977; Abbagnano, et al., 1947.

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