SOME TURNING POINTS IN THE EARLY SOCIOLOGY OF ROBERT KING MERTON

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ABSTRACT

Robert King Merton's early sociology of science is significant for the understating of modern sociology. The relationship between unplanned consequences and developments in science and technology is fundamental for a definition of the contemporary picture of social action developments. Theoretical interests link to the *working-in-progress* formulations. Empirical development emerges from these perspectives. The significance of the theoretical progression encapsulated in the American sociologist's doctoral dissertation is astounding (1938). The theory-research connection is equally significant when placed in relation to the scholarly output of the 1950s. In addition, the questions posed by Merton apply in the 1970s and 1990s sociology. They are fertile with interesting answers even today, which is a dramatically disturbed time due to the technological progress. This progress raises new ethical, political, and social questions about the future of humanity. Other sources of disorder derive from the ecological crisis that leads to a rethinking of the man-environment relationship. Merton does not address this topic. The twentieth-century totalitarianisms that have survived into the twenty-first century embed dangerously within the scientific technological development (e.g., the China case). The development of new medical-biological theories and practices impose new questions about the value attributed to life. This is of particular relevance today due to the global and devastating Covid 19 pandemic crisis.

Keywords: science and technology; sociology of science; history of sociology

1.- Introduction

As is generally known, the American sociologist Robert King Merton (1910-2003), during the early phase of his scientific and intellectual work, dealt with topics and issues concerning the sociology of science, of which he may be considered, to some degree, the initiator. Beyond general clarifications of a biographical (P. Sztompka, 1986, 34 et seq.; C. Crothers, 1987, p. 23 et seq.) and systematic nature (C. Calhoun, 2010, 2017-, p. 113 et seq.; G. Rinzivillo, 2019, p. 385 et seq.) which we find in the literature of both the past and

of today, Merton's specific kind of interest in the sociology of science had remote origins rooted mainly in his PhD thesis. In that dissertation, he held that the discipline should involve an examination of the dynamic interdependence between science, as a social work-in-progress determining cultural products and civilisation, and the structures of the social environment within which it operated. In this sense, it needs to be said that, generally speaking, scholars, although they acknowledge the relationship existing between science and society, tend to consider the influence of science on social contexts rather than their reciprocal impact, as well as how society affects science. In reality, however, the choice of topics that scientists deal with is largely defined by the vested interests of the contingent reality. Early on, Merton sensed, in particular, that the idea on which science was based - that truth was something that might be rationally ascertained by means of observation and experimentation - did not stem from science itself, but from the broader sphere of the cultures to science belonged. For him, science was, therefore, a social as well as a historical institution. (P. Burke, 1992, II).

In practice, Merton sought to highlight the fact that the institutionalisation of science, along with the codification of the social role of the scientist, presumed the existence of a set of values and norms capable of gradually characterising the scientific community itself. This, while admitting that the Theory-Research rapport might smack of this kind of ambivalence, resorting to the development of concepts and fields of empirical research extremely pertinent to the perspective of the sociologist. He stressed the link between the institutionalisation of science and the core of social values and norms upon it rested, in particular, the mechanisms by means of which resources and rewards, like the possibility being published and prestige, were assigned and allocated within the scientific community. He also foregrounded the organisational and functional aspects of science as an institution, all of which taken together define "*the social stability*" and "*the institutional integrity*" of science. One of Merton's great merits was, unlike the great theorist Talcott Parsons, that of devoting himself to empirical research with a view to integrating it realistically into theory. He paid enormous attention, therefore, to the logic of the scientific community and to the tensions between it and society at large. In the scientific community, Merton, more than others defined a specific *ethos* based on the key value to attribute to systematic doubt as well as on the fact that every statement needed to be intersubjectively verifiable, on open dialogue between scientists, on the universal availability of all research findings, on the evaluation of a scientist exclusively in relation to the merits of his/her work. What he meant was that

science would be authentically science only if it had an organisation which permitted doubt to express itself: as long as this ethical imperative existed, science might develop.

The text we shall examine in detail is "*Science, Technology and Society in Seventeenth-Century England*, first edition 1938, published in Italian as late as 1975 and entitled "*Scienza, tecnologia e società nell'Inghilterra del XVII secolo* ", with an introduction by Filippo Barbano of the University of Turin (R.K. Merton, 1975), where Italy's sociological analysis of the history of science began. With almost maniacal care, Merton examined written sources dating back to the seventeenth century produced by a number of authors of the time, from Francis Bacon to Isaac Newton, including theologians, philosophers, scholars, authors and pedagogists; he consulted the registers of the Royal Society, a broad range of writings of various kinds and came to identify the various reasons which led science to acquire prestige and significance in the seventeenth century. Science did not arise spontaneously, but after a lengthy period of cultural incubation of values present in the religious environment of Puritanism, supported by rationalised human industriousness, while favouring public works meant to glorify God and salvation. Max Weber, with his *Protestant ethics and the spirit of capitalism* (1905) had already investigated the origin of modern capitalism and the reasons why it had imposed itself in modernity, reasons he associated with the Calvinist faith. Merton, on the other hand, by analysing empirical data, also highlighted how economic and military issues influenced scientific research, demonstrating the link between the application of science and conspicuous increases in technological advancements in the England of the seventeenth century. So, Merton's 1938 text ushered in the sociology of science and a pathway through the history of science. The Mertonian approach to the sociology of science has the merit of having underlined the fundamental importance of the scientific community, the underlying cumulative nature of knowledge, the normative principles that should inform the ethos of every community of scientists (universalism, communitarianism, disinterest, organised scepticism).

An approach like this appeared excessively optimistic, however, and could not escape criticism. The vision of the Philadelphian sociologist appeared static, so, his assumption of the cumulative nature of scientific progress was challenged, radically, by historian of science Thomas Samuel Kuhn, whose most important work. *The Structure of Scientific Revolutions* (1962), has become a fundamental reference text for studies in the field, not only of sociology but also of the philosophy of science. The success of Kuhn's work gave rise to the crisis of Merton's model. "The Mertonian school of the sociology of science is accused of practicing idealism, of modelling abstractness, of confining the institution of

science within narrow and immobile boundaries, scarcely permeable from the outside, of an inability to grasp the discontinuities existing within science itself which, following Kuhn, are attributed essentially to social factors" (G. Statera, 1997). Kuhn's fame overwhelmed Merton's extensive theoretical work for a considerably long time. In Italy, for example, senior secondary school students who study philosophy, know something about Thomas Samuel Kuhn while ignoring Merton's sociology completely. Yet, in the fields of the sociology of science, philosophy and history, his text *On The Shulders Of Giants: A Shandean Postscript* (1965), in Italian, *Sulle spalle dei giganti Poscritto Schandiano*, (R. K, Merton, 1991) with an introduction by Umberto Eco, revealed his lively erudition and inexhaustible intellectual curiosity, starting from a frequently quoted aphorism, also used by Isaac Netwton in a letter to his rival and colleague R. Hooke, "if I have seen further, it is by standing on the shoulders of giants", tracing the origin of the famous phrase back to the Middle Ages when speaking about known and unknown scientists, writers and philosophers. Another interesting and original work, *The Travels and Adventures of Serendipity, A Study in Sociological Semantics and the Sociology of Science* (R. K. Merton, 1992, 2002), written with Elinor G. Barber as early as 1958, was put aside back then. Serendipity, a term invented by H. Walpole in 1754, suggesting that quickness, intelligence, and insightfulness combined with luck, can permit one to make felicitous unintended discoveries. This term was introduced into the social sciences by Merton in the 1940s to denote a particular aspect of scientific discovery, that reached by accident. In the concluding part of *Serendipity* we find the illuminating "Autobiographical Reflections" written shortly before the book's publication. Here, Merton dealt with various topics, in particular the serendipitous microenvironments from which the key ideas informing Thomas S. Kuhn' the famous and influential work of stemmed, *The Structure of Scientific Revolutions* (R. K. Merton, 2002, p. 396) and the origin of the Kuhnian concept of "paradigm". Long before Kuhn, Robert Merton had actually used the term "paradigm" when advocating the need for a more rigorous methodology and greater awareness of the theoretical structure of sociology. This autobiographical excursus, one of his latest writings, confirms the stature of man and thinker, a giant on the shoulders of giants.

2.- An emblematic work

Begun in 1933 as a doctoral thesis and completed two years later, *Science, Technology and Society in Seventeenth-Century England,* was published originally in 1938 as volume IV, part II, of *Osiris: Studies on the History and Philosophy of Science, and on*

the History of Learning and Culture (R. K. Merton, 1975, p. 75) thanks to the editor and founder of Osiris, George Sarton, Merton's professor. In the Preface, dated 1937, the young Merton wrote that his work might have borne the title "Some sociologically relevant aspects of certain phases of the development of science in seventeenth-century England". It was an empirical study of the genesis and development of some of the cultural values which had acted as the foundations, the cultural roots, of science as a form of research aimed at increasing verified knowledge as empirically confirmed and logically valid prediction. This was a specific study of the "non-logical" (extra-scientific) roots of the scientific development which took place during an era of considerable progress in the history of new science and technology, a period that also saw the birth of the Royal Society. It was in the author's interest, to back, on the basis of empirical data, the widespread opinion whereby "the science of every period does not live separated from the social and cultural context" and identify "these relations as they manifest themselves" (R.K. Merton, 1975, p. 59). The argument, unjustly neglected by American sociologists, that "this was a period in which the sociology of science was in hibernation" (R. K. Merton, 1975, p. 33) appeared like a meteor set to limit "a condition of such evident neglect "(R.K. Merton, 1975, p. 33) in the treatment of issues relating to the behavioural models of professional scientists. Those were the years of the Great Depression, when sociology took a keen interest in the problems of the large cities, the family, racial groups, juvenile delinquency, vagrants, thieves, beggars, travelling salesmen, but not in science as a constantly developing social institution. These constants of American 'period-bound' sociology were emphasised by Merton in his early scientific and intellectual work which foresaw a *screening* of social action and anomie (R.K. Merton, 1936, pp. 895-904; 1938, p.672 -682; 1949, p.226-257; 1955, p. 24-50; 1964, p. 213-242) as well as dedication to the development of categories that could not be used in the theoretical and empirical fields (R. K. Merton, 1945, p. 462-473; 1948, p. 505-515; 1957, p. 106-120; 1959, IX et seq.). Yet, according to professor Filippo Barbano, Merton's text of 1938, provided two interpretative keys, "one specific to the sociology of science and another, regarding historical sociology, so to speak" (R. K. Merton, 1975, p. 15). It was a work of research steeped in historical meaning, endowed with a refined methodological structure, rich in precious, erudite information and wide-ranging historical-social views. "For the young Merton of the 1930s, the sociology of science already had, as its object, not so much *Science* as such but the 'social problem' it implied". In his Preface to the 1970 re-edition of this work, the author admitted that, even after thirty years, it had retained a particular and emblematic interest, both because of how its contents had been developed by the sociologists of science, and

because of the great changes that had occurred in the relationships between science and social and cultural contexts in various parts of the world since then. This remains true today, after eighty years. The questions that Merton asked himself in the thirties were still valid in the seventies and produce interesting answers even today, in times dramatically marked by technological and scientific progress which poses new ethical, political and social questions about the future of humanity. Other sources of concern derive from the ecological crisis which urges rethinking of the man-environment relationship - with which Merton did not deal - from the twentieth-century totalitarian theories that survived into the twenty-first century to be dangerously strengthened by scientific and technological developments (the case of China is emblematic), and lastly, by the development of new medical-biological theories and practices that raise new questions about the value to attribute to life and which assume particular importance today as we seek to counter the recent devastating, globalised Covid-19 pandemic.

The fundamental issues addressed in the work in question arose from the questions that Merton clarified in the Preface to the 1970 re-edition of his 1938 work. “What are the modalities of the relationships between society, culture and science? Do they vary in genre and magnitude in different historical contexts? What leads to relevant changes in individual choices, made within the various intellectual disciplines, sciences and humanities involving important variations in their development? Among those engaged in scientific practice, what leads to changes in the focus of research interest from one science to another and, within each one of the single sciences, from one set of problems to another? Under what conditions are changes in the focus of attention the result of a calculated, deliberate line, and what are the largely unforeseen consequences of value orientations among scientists and among those who control the livelihoods of science? How did these questions arise when science was being institutionalised and how do they arise at the moment of its complete institutionalisation? Once science has developed forms of internal organisation, how do the genres and pace of social interaction affect the evolution of scientific ideas? ” (R. K. Merton, 1975, p. 57). Another of the points which Merton clarified remains relevant today. This was the fact that, while the issue of how science conditions society was given considerable attention within the historical sociology of science, the issue of the impact of society on science received less attention. The topics dealt with in the monograph in question were the following: “The origin of the people who devote themselves to the various professional fields and changes of interest among the sciences (chapters 2-3), the hypothesis of the relationship between Puritanism and science (chapters 4-6), economic and military

influences within the field of scientific research (chap. 7-10 and Appendix), population, social interaction and science (chap. 11). The space dedicated to economic and military influences received a slightly larger space in the text than Puritanism and cultural values, but the interest and attention of the specialised press and reviews focused on the three chapters regarding Puritanism and the institutionalisation of science. Again, in his 1970 Preface, Merton preferred the text relating to the impact of economic and military factors upon the sciences (chapters 7-10) for various reasons: he believed that here he had used a better method of investigation and a more acute formulation of the theoretical ideas compared to the previous chapters. He observed, moreover, that in the text he had always made a clear distinction between science and technology, a distinction not always made and compromised considerably even today. Another distinctive feature of his argumentative system concerned his refusal to adapt to a vulgar form of Marxism or purism, that is "to choose simplistically between the point of view whereby the selection of matters to research was determined entirely by economic and military interests, and that whereby they were by no means determined by similar interests." (R. K. Merton, 1975, p. 40). Another peculiar distinction was that he made between institutional and motivational levels of analysis. "In the behaviour of scientists, then as now, subjective intentions and objective consequence are analytically distinct: sometimes they coincide, at other times they differ" (R.K. Merton, 1975, p. 41). The author, also thanks to the elaboration of numerous data, was already making his way towards the idea, later developed amply, of unintentional consequences (R. K. Merton, 1936, p. 896). Another point of merit we find in the monograph and which Merton himself acknowledged in the 1970s, was the use of statistical evidence leading to imperfect conclusions though imperfect were not hasty. "Quantitative orientation has the task of putting interpretative ideas to the test, as far as possible, by confronting them with appropriate compilations of statistical data, rather than relying completely on the scraps and fragments of evidence which come to the attention of the scholar simply because they conform to his ideas". (R. K. Merton, 1975, p. 42). Merton painstakingly analysed in his work, the entries (29,120) contained in the Dictionary of National Biography and discovered that during the first half of the seventeenth century there was an increase in interest in science and technology, while the greatest degree of progress was recorded for physics, astronomy, medicine and mathematics, while only a moderate degree of progress regarded the fields of botany and zoology. It is important to remember that seventeenth-century England experienced disorders and uncertainties due to the two domestic revolutions, which partly affected the development of science. Scientific development in England began to receive

support towards the middle of the century. During the first phase, the big names were Gilbert and Harvey with Francis Bacon as stimulator, during the second period Newton, Boyle, Hooke, Huygens, Halley and others, came to the fore. Experimental philosophy became fashionable, was looked upon favourably by society, whose cultural values provided it with support and thrust.

3.- The complex interweave of cultural factors that generate, influence and sustain science

The remarkable growth in the number of scientists, an increase in the interest, organisation and credit that science obtained in the seventeenth century in England revealed a change in trends compared to the past. “Religion is an expression of cultural values, and in the seventeenth century it was the clearly prevalent mode” (R. K. Merton, 1975, p. 116). Merton investigated the relationship between Puritanism and science in the course of the actual social changes during that century of remarkable scientific and technological progress. Despite the presence of 107 Protestant sects in the British Isles at that time, all of them shared a common set of basic values. Just like Max Weber, who hypothesised that the Protestant ethic, in particular Calvinism, had strongly influenced the development of capitalism, Merton also believed that, in Britain, there had been a relationship between scientific-technological culture and nascent capitalism, a connection that was likely to have existed between Puritanism and science. The one or sole true purpose of the life of an English Puritan was the glorification of God. One way to achieve this, was to be useful to others and to society in general, while public works were considered the best way to serve God. Social utilitarianism, as a laudable means of glorifying the Creator, lent itself to concrete applications, becoming the guiding principle of various kinds of real-life practice. Predestination, another of the fundamental pillars of the Calvinist faith, could be satisfied by striving towards the certainty of salvation through the state of grace experienced by the achievement of “good works” as the realisation of earthly activities of use to one's neighbour and society at large. Glorifying God, being predestined for salvation through good works performed within the ambit of concrete earthly life, urged Puritans to engage in constant, industrious, committed, methodical work, as a guarantee of professional success. The fundamental principles of Puritanism justified work, opposed idleness and leisure, required “participation in the affairs of this world” (R. K. Merton, 1975, p. 123). For Puritanism, as a powerful social force, the choice of one’s profession was of the utmost importance and the

learned professions were to be preferred. For this reason, education was held in high regard. Furthermore, reason, the exclusive patrimony of the human being, was necessary for control over voluptuousness and idolatry, but, above all, it permitted people to appreciate the creation, those works of God which manifested His glory. The science of nature, studied with rational rigour, became an autonomous and effective means by which to glorify God, as Anglo-Irish scientist Robert Boyle wrote in his apologetics of science. The Puritans held that education should not deal with the arts and literature, which they considered a useless waste of time, nor should it focus on scholastic philosophy, not even on that of the pseudo-Aristotelians, because these led to error, starting from false premises, while the syllogistic method could only lead to false conclusions. Mediaeval monastic asceticism, on the other hand, had debased matter and deemed the natural sciences deceptive. It is useful to recall that, in 1163, Pope Alexander III, during the Council of Tours, forbade the study of physics by ecclesiastics, the only people who had the means by which to devote themselves to those studies, back then. Luther himself opposed the classical sciences and arts, but the English Puritan religious movements had a positive impact upon scientific activity, making it socially acceptable, commendable and urging talented men to take up science. The studies favoured most by the Puritans were mathematics, which, they believed, best represented the development of reason, and physics which they believed to be the study of God through his works.

Merton availed himself of the thinking of the Reverend Richard Baxter, who, more than others, had represented more completely and in greater detail the spiritual perspective of the Puritan era in his Christian Directory, written between 1664 and 1665. Baxter in his advice to young students had written that “empirical proof is required to accept or reject a theory; unless you submit theses to the appropriate test, that is not science, but simply human conviction; what you are able to deduce otherwise?” (R. K. Merton, 1975, p. 127). By reason the Puritans did not mean abstract rationalism but a means for "rational examination of empirical data". “To logic they relegated a secondary role. (...) This orientation combined with "irrational" faith which proved efficacious and useful to science, characterised both Puritanism and modern science ”(R. K. Merton, 1975, p. 128). Science was practically sanctified because it was useful to mortals, technology, a direct expression of scientific study, served the well-being of man and, so, was good in the eyes of God (utilitarianism). Empiricism and rationalism, closely linked to each other in favour of mechanical knowledge, were beatified and sanctified. Puritanism produced a change in social orientations, so much so, that the positive reputation of science increased. Along the

new scale of values, the laziness once practiced by the nobles and the wealthy was abandoned in favour of honourable activities, fruitful and appreciable duties where one was expected to employ one's energies. The belief in the immutability and uniformity of the laws of nature led to the idea that, if society had progressed in the past, it would also do so in the future. The Puritan system of values led to psychological attitudes favourable to science, so much so, that large numbers of Puritans rose from the burgeoning bourgeois and merchant classes, the increase in whose power had been favoured precisely by science and technology.

The social and economic importance of the Puritan bourgeoisie, devoted to science, prompted fervent confidence in progress. The limits imposed by the class structure of the times prompted political revolution. Examining the writings of the scientists of the time, - the natural philosopher Robert Boyle, the first modern chemist and pioneer of the scientific method, the great botanist John Ray, the zoologist Francis Willughby, the mathematician Isaac Barrow and the great, well-known Isaac Newton, - and analysing the history of other contributions to the Royal Society in depth, Merton studied the process of institutionalisation of science in Britain and investigated the parallelism between English Puritanism and German pietism, which expanded, above all, in the pedagogical field (Comenius). On the basis of the data provided by the Royal Society, Merton identified the correlations existing between scientific research and social, economic and military needs. The fields of interest of major impact were those related to maritime transport and navigation (magnetic maps, hydrography, longitude and latitude, tides, buoyancy, observation of celestial bodies, wood suitable for ships) mining and metallurgy (water pumps, mine aeration, humidity, excavation, air compression), military technology (studies regarding trajectories, speed, resistance, free fall, compression and expansion of gas, recoil) as well as textile and agricultural technology.

These British scientists seemed to have been fully aware of their country's problems and endeavoured to solve them. The influence that interests of a socio-economic and military nature exercised over the choices made by men of science was considerable. Merton stated that his next goal would be that of establishing the existence of a general sociological theory of scientific development, seeing that, in every society and civilisation, certain values emerged when one examined the culture as well as empirical and scientific knowledge used by men to seek to control nature. In his 1938 text, Merton posited the existence of relationships between population density and discoveries, inventions and scientific-technological progress. The inventiveness of the scientist was, he held, related to creativity, to individualism, (which indirectly implied opposition to authority), to a spirit of free

and progressive research, to educational processes (things and not words), to techniques of self-government, uniformity of intention aimed towards the main goal, as well as reciprocal interaction and exchange of observations and points of view between scientists. This marked the origin of the scientific community and the public nature of research: science became a social activity. This social activity needed to be autonomous while remaining linked to the rest of society.

4.- Science and values

The Philadelphian scholar began proposing theories regarding the ethos of science, given the aversion to, attacks on and criticisms of the integrity of science at a time when the splitting of the atom and the subsequent uses made of it during the Second World War became common knowledge. In the play *The Physicists*, written in 1961 by the Swiss playwright Friedrich Dürrenmatt, the physicist Mobius expressed himself as follows, "Our science has become tremendous, our research dangerous, our knowledge mortal" (F. Dürrenmatt, 1972, p. 69), highlighting issues regarding the ethics of science after the use of the atomic bomb in Japan. Merton dealt with the issue in two essays, *Science and democratic social structure* and *The normative structure of science*, republished in Italy, in 2011, as *Scienza e struttura sociale democratica* and *La struttura normativa della scienza*. “An institution that suffers an attack must re-examine its foundations, reformulate its objectives and seek its rational justification: crisis invites self-criticism” (R.K. Merton, 1971, p. 968). In the seventeenth century, natural philosophers felt the strong urge to justify science as a means by which to glorify God by studying His works. Scientific research, they sustained, was not an end but a means. Over the centuries, the continuous successes reaped by research turned the means into an end. “Thus, possession of this strength induced the scientist to consider himself independent of society and see science as a business to be managed according to autonomous criteria of self-validation, which was indeed in society, but not of society. (...) This process led to the clarification and affirmation of the ethos of modern science.” (R. K. Merton, 2011, p. 106). The theme of attacks on science is extremely topical and early Mertonian sociological thinking may be used to prompt further studies aimed at helping one to understand and cope with the difficulties of scientific research, with the products of technology, the relationship between science and politics, science and the environment in today’s society. The complex definition of “science” proposed by Merton in the aforementioned essays is useful and clarifying. Science, he

posited, should include " a) a set of specific methods by means of which knowledge is verified; b) a set of accumulated knowledge, deriving from the application of these methods; c) a set of cultural values and customs that regulate activities defined as scientific; d) any combination of the aforementioned " (R. K. Merton, 2011, p. 106).

Science required, he argued, the mutual action of many minds, of contemporary scholars and thinkers of the past; it also implied a more or less formally organised division of labour; it presupposed emotional detachment, integrity and honesty on the part of scientists and was, therefore, oriented towards moral norms; and finally, the verification of scientific conceptions itself, was, fundamentally, a social process. Merton held that the autonomy of science might be guaranteed by the existence of the scientific community (a theory developed before Thomas Samuel Kuhn used it), charged with formulating and ensuring the use of specific normative principles regarding both research procedures and the behaviour of individual scientists. "The *ethos* of science is that set of values and norms, invested with emotional tones and considered binding for the man of science. Norms are expressed in the form of prescriptions, prohibitions, preferences and permitted directions, and are legitimized in terms of institutional values" (R. K. Merton, 2011, p. 107). As we are well aware, the ethos of scientific communities makes use of the following principles: universalism, communitarianism, selflessness, systematic doubt. The first principle was *universalism* whereby every statement (claims to scientific truth), had to be subjected to the scrutiny of "*pre-established impersonal criteria*, in accordance with observation and previously confirmed knowledge. Accepting or rejecting any proposition in the corpus of science must not depend on the personal or social characteristics of the scholar, because his race, nationality, religion, class and personal qualities are, as such, irrelevant. Objectivity excludes particularism" (R. K. Merton, 2011, p. 109). Chauvinism, nationalism, ethnocentrism, he believed, were incompatible with science. There had been moments in history which foregrounded universalism as a shared standard, when, for example, scientists accused themselves of nationalistic prejudices, of intellectual dishonesty; this happens, for example, in times of war, in particular. He sustained that universalism should make scientific careers available to all those who had the necessary ability and the skills and that this would stimulate the advancement of knowledge. He believed that democratic values favoured the universalism of science because the principle was constitutive of the political system itself. His point was that universalism referred, basically, to how scientific claims and results were judged, something which needed to concern the results alone, without taking into account the characteristics of the scientist who had formulated them, his/her social class, his/her

race or religion. In Merton's opinion: “accepting or rejecting any proposition in the corpus of science must not depend on the personal and social characteristics of the scholar” (G. Rinzivillo, 2019, p. 98). Again, he specified that “when the broader culture is opposed to universalism, the ethos of science is subjected to serious tension: ethnocentrism is not compatible with universalism. All this often means that the scientific ethos is appraised in contrast with more general social values, so that freedom of access to research can be affirmed precisely as a value to be achieved and, therefore, also as a norm made operative. Deviations from the norm of universalism are not included, along with reference to certain extra-scientific characteristics which persist to the extent that they are invoked and oppose the achievement of a set of rules that socially affect the culture and particular ways of acting of scientists belonging to a community ”(R. K. Merton, 2000, p. 1064) The author also argued that universalism might be affirmed in theory and fail to be effective in practice; however imperfectly it might be in practice it belonged to the fundamental democratic guiding principles. Therefore, universalism rejected the idea that a scientist might be discriminated against on the basis of his religious faith, his political beliefs, his/her ethnic group or other variables relating to his/her person. (R. K. Merton, 2000, p. 1064)

Merton’s second principle was *communitarianism* meaning that science as a common heritage meant that all discoveries should be communicated, shared, made public. Merton noted that: “*the communitarian nature of science also reflects in the scientists' recognition of their dependence on a cultural heritage over which they can make no claim of privilege*” (G. Rinzivillo, 2019, p. 61). In more substantial terms communitarianism implied that science was a collective product and a matter of common heritage. He held that science was a social activity based on previous efforts, destined to be influenced by future ones; the contribution made by the individual scientist was, therefore, repaid in terms of prestige and social recognition (which might eventually materialise in subsequent career advancements) (B. Tosio, 2011, p. 24). Scientific research assumed, therefore, the character of a “competitive cooperation”, where the results of the research were shared while competing for priority and authorship. The scientist should not hesitate to publish the results of his/her research, but do everything possible to obtain acknowledgement as the first to reach them. Esteem of the originality of the discovering scientist, the attribution of eponymy, the recognition of skills, were the rewards typical of competition among scholars. There had been controversy among scientists over the attribution of priority. Merton cited the case of Newton - Leibniz and calculus, an incident which did not threaten, however, the fact that calculus became common property. Another aspect of communitarianism was recognition of previous

contributions, “the humility of the scientific genius is not only culturally appropriate but results from the awareness that scientific progress implies the collaboration of past and present generations” (R.K. Merton, 2011, p. 115). In essence, Merton first described the normative structure of science, that is, the values and rules of conduct meant to guarantee how the production of knowledge should function. Merton’s thesis of the norms that should regulate the behaviour of scientists indicated the values he held should form the basis of the ethos of modern science, implying “the persistent repudiation by scientists of the application of utilitarian norms to their work”. Merton also pointed out that the adoption of these standards was a condition essential to the production of objective and rational knowledge. He believed, for example, that communitarianism as defined by him was incompatible with the private ownership of technological discoveries and inventions even in a capitalist economy. The question was neither clear nor simple.

The third principle was *selflessness*. The true interest of the scientist should be the progress of science, the quest for scientific truth. As to a lack of self-interest in/of scientific research, this lay in the fact that the researcher's primary objective was the advancement of knowledge, by means of which it was also possible to obtain individual recognition indirectly. Progress was not a cumulative indicator, of course. The American author believed that science should have as its sole institutional objective the growth of verified knowledge. Personal interests were meant, therefore, to be excluded from the scientist's work. Communitarianism (the moral obligation for all scientists to make every new discovery known publicly to their colleagues) and selflessness (the moral drive to put the interests of the community before his/her own individual interests) were indispensable to ensure that each new claim to knowledge would be examined critically in the light of universally accepted criteria (M. Cini, 2004, p. 263). The last of his institutional ethical imperatives was closely linked to the previous ones, as knowledge always needed to be tested. The accumulation of knowledge proceeded by means of trial and error. In this sense, the discovery of an error in a scientific theory also represented a step forward, not failure. Knowledge might be considered valid until proven otherwise and until the affirmation was surpassed by better theories, or by those better suited to the observed empirical reality. Organised scepticism "does not recognize the boundary between the sacred and the profane: anything can and must be questioned, criticized, modified or rejected, in an infinite process of continuous revision where dogma or faith have no place". In science, any other interest, economic, power, prestige needed to be subordinate to the benefits of a disinterested form of activity, thus avoiding sanction and psychological conflict. When compared with other professional

activities, again according to Merton, science was free of fraud; that is, scientists were, it appeared, endowed with a profound sense of moral rigour, although that was not the point. “The activities of scientists are subject to such a degree of rigorous control that it is unmatched in any other field of activity. The need for disinterest has a solid foundation in the public and controllable nature of science, and this circumstance may be assumed as having contributed to the integrity of the man of science ” (R. K. Merton, 2011, p. 117).

The fourth principle was *systematic doubt* or *organised scepticism*. On the one hand, it was the duty of all scientists to submit their results to the careful and critical scrutiny of other scientists; on the other hand, all of them also had the duty to monitor the work of their colleagues. Experiments needed to be reproduced and replicated within the scientific community. Scientists had to be prepared to have their results critically evaluated, which meant suspending all judgment until the necessary approval was obtained. Furthermore, “the scientific researcher does not respect any distinctions between the sacred and the profane, between what requires uncritical respect and what may be objectively analysed” (R. K. Merton, 2011, p. 119). Merton also mentioned the problem of the intrusion of science into fields managed by economics, politics and, in the past, religion, as well as the intrusion of politics, economics into science itself, which received limitations, amputations, or inadequate thrusts, contrasting with the ethos of the interconnected principles he posited. In conclusion, we notice how Merton's imperatives, often referred to with the acronym CUDOS, summed up practices that had been consolidated since the European scientific and technological eighteenth century served as a specific model for the production of knowledge by academic communities. These principles, although often disregarded at individual level, had dominated the life of science and come to be considered inseparable from its empirical norms. They reflected the idealised image of the world of university research, as practised by universities, until the 1950s. In that period, it was above all the state which supported science, leaving wide margins of freedom and autonomy to researchers, to whom it attributed the positive role of promoters of social development and well-being. In any case, Merton's imperatives are still an ideal reference point, although, nowadays, scientific research and technological innovation have actually brought about profound changes (M. L. Villa, 2016, p. 30).

These principles constitute a general code of the ethics to which scientists should aspire and abide by, but they do not illustrate the actual behaviour of scientists. Merton, over-optimistically perhaps, argued that these principles were rarely violated by scientists. The Mertonian approach has received numerous criticisms. Merton “does not deal at all with

the team work carried out by scientists and the management of particular problems connected to the work of the "scientific community *tout court*" (G. Rinzivillo, 2019, p. 61). The Philadelphian sociologist referred only to given moments of the history of science to support his hypotheses. One might argue that his description of the scientific ethos seems to remain at a disarming level of generality. His attention was not directed towards the activities that each individual member conducted, separate from the others, even though this activity belonged to an organic and general plan established by the participants in a given research project (G. Rinzivillo, 2019, p. 61). The Mertonian model has also been criticised for failing to predict change. This, in a certain sense, contradicts the sociological attitude towards the examination of particular situations of detachment, like bureaucracy or the assimilation of social roles (RK Merton, 1945, p. 405-415) as well as the fulfilment of self-evident prophecies (R. K. Merton, 1948, p. 193-210) or situations of particular commitment for the sociologist in society (R. K. Merton, 1957, p. 3-79) or, finally, the apprehension shown towards ambivalences sustained by scientists and sociologists (R.K. Merton. 1961; 1963, p. 77-97; with Barber E.G., 1963, p. 90 et seq.; 1970, p. 1-25; 1976, I, II). There is also the issue of the limits imposed upon the structural settlements by the various controversies triggered by social action (Clark J., Modgil C and Modgil S., 1990; L.A. Coser, 1975, p. 85 et seq.; P. Donati, 1987, p. 237 et seq.). Moreover, these considerations may be applied to the discussion many scholars undertook a few decades ago almost to the point of outlining a pathway (A. Giddens, 1990, p. 97-110) which found confirmation in the configuration of the progress made regarding the understanding and actualisation of the sociology of science posited by Merton (M. Bucchi, 2001, p. 655-659).

5. – Merton's revision of functionalism

The fact is that the development of the theses underlying structural analysis according to Merton's sociology (R.K. Merton, 1975, p. 154 et seq.; 1995, 3-75) as well as the increase in attention paid to aspects dependent on theory and empirical research (R. K. Merton and A.S. Rossi, 1950, p. 40-105; R.K. Merton, v. Merton and E.G. Barber, 1983, p. 15-40) forged a link between early thinking regarding the sociology of science and other dimensions of Merton's scientific contribution. This directed his efforts towards the issue of mass communication we find in the studies he carried out with Paul Felix Lazarsfeld, where his functionalist perspective differed from that of Talcott Parsons and was reflective and more "prudent". This well-known aspect took concrete form in the so-called "medium range

theories" or "intermediate dispositions" (G. Rinzivillo, 2019), where Merton criticised early functionalism (L. Gallino, 1996, xi-xiii) which had exalted the rationality functional to social practice. The theorists he criticised had adhered to three conceptual assumptions which Merton did not share, namely, (a) the postulate of the functional unity of society, according to which society was a functional whole with all its parts integrated and well-balanced; (b) the postulate of universal functionalism, according to which all cultural and social practices were functional; and, finally, (c) the postulate of the indispensability of functions, for which there existed universalising functional prerequisites for each society though only specific socio-cultural elements were capable of satisfying these functions. Merton's proposal to revive functionalism stemmed from a critique of these postulates. First of all, with respect to point (a), he abandoned the primigenial functionalist vision according to which we live in the best of possible ways; many practices persist despite there being no particular benefits either for individuals or for society. Secondly, with respect to point (b), he noted that the early functionalists tended to focus on the so-called functions for society, while, the idea of society as a whole, according to Merton, was misleading because the same social element which might be functional for certain individuals, groups or systems might prove dysfunctional for others. Finally, with respect to point (c), he sustained that while functionalist accounts brought together the subjective states of individuals and objective consequences: while the function of practice was the observable effect which needed, therefore, to be distinguished from the motivation underlining the practice itself. Hence the well-known distinction he made between manifest and latent functions.

The study of "subjective deprivation" carried out previously by Samuel Stouffer had taken into account this diversity of interests while representing social groups in a more realistic manner. Merton showed that each individual related to at least two groups. On the one hand, to the group they belonged to, on the other, to their reference group. Group dynamics and possible conflict (which Merton does not seem to have analysed when defining scientific ethos) were generated, disavowing the principle of communitarianism. Universalism, on the contrary, was undermined, he held, by the might of extra-scientific factors. The existence of lobbies within universities and academic institutions questioned all issue of ethos. In 1974, Ian Mitroff - p. 591-, in a study of NASA's Apollo scientists, postulated the presence of a counter-norm for every dominant rule. If there were serious reasons why the concept of emotional neutrality and universalism should be considered as norms of science, there were also serious reasons for indicating emotional involvement and particularism as counter-norms opposing science (H. Etzkowitz, 1999, p. 7-28). Likewise,

secrecy was the opposite of communitarianism, interest of disinterest, while organised dogmatism was the opposite of organised scepticism. The traditional norms of science, those expounded by Merton, came into play when scientists were concentrated on well-structured problems; on the contrary, counter-norms characterised poorly-structured problems like those encountered during the race for the moon.

In the long run, Merton is recognised unanimously as the founder of the sociology of science. His main insights, as we have seen, form the bases upon which subsequent studies which have often taken different paths and outcomes, rest. Essentially speaking, his vision of society was less accommodating and left room for criticism, because the social scientist might also disapprove of the coherent course of things. His theory allowed the sociologist considerable critical room, as it introduced new notions into the principles of this sociological theory and into the analytical methodologies adopted. Merton, by claiming that institutions, did not limit themselves to bringing benefits, that they also caused harm, recognised the relativity of functional meanings. This meant that pone needed to understand, every time, from whose point of view a matter might be deemed useful or harmful, an institution or a social event might prove functional or dysfunctional. The same need of/in society could be satisfied by different institutions. In reality, functionalism ceased, for a moment, to be a theory which one might also accuse of ‘narrative’ conservatism (A. M. Zocchi Del Trecco, 1998; 2016, II, IV) and maintenance of the status quo. Making some analogies, the major functionalists were interested in the individual side of society and tried to explain why individuals moved in harmony. For Merton, the individual contributed actively to the construction of the social reality; he did not consider the simplest things; it could happen that society might push the individual to set him/herself specific goals, without knowing, however, how to provide him/her with the means by which to achieve them. In actual fact, Merton’s theory of action, intentions and consequences, may be read as a reply to the accusation of determinism which, at least from the perspective of methodological individualism, was made against macrosociology. One might fall into determinism, Merton seemed to affirm, not only by attributing excessive importance to the social determinants of behaviour, but also by looking for explanations regarding the effects of individual and collective action exclusively in the inclinations, attitudes and opinions of individuals. If we wish to summarise the thesis, the American author developed concerning sociological functionalism, as a kind of provocation, we might say that he believed that an important part of the autonomy enjoyed by individuals was that from their own intentions. Individuals not only took a stand with regard to the multiple demands of society, but also helped define them; taking up the Theorem of

Thomas which stated that “If men define certain situations as real, they are real in their consequences”. Therefore, individuals, he posited, regulated themselves rather than to the social world as it was, to the social world as they perceived it.

The first part of the theorem is yet another authoritative clarification of the fact that human beings do not respond only to the objective elements of a situation, but also to what the situation means to them. Once they have attributed some kind of meaning to a situation, this becomes the cause determining their behaviour and some of its consequences. Merton, when discussing functionalism, underlined the presence of interest groups within contemporary societies which some may find useful, others harmful and, finally, he stepped back from Parsons' theory of social action, according to which all individuals acted rationally. On the contrary, as Merton believed that people did not always act consciously, he made a distinction between manifest (conscious) and latent (unconscious) functions. In this regard he identified two main groups with which individuals relate: their *membership group*, that is the group which impacts upon most of one’s life, and their *reference group*, that is, a set of individuals to whom given ideas and values refer. The gap between the two groups often caused frustration, so that it was possible to find continuity between cultural goals and the means by which to achieve them, meaning that individuals as a result of this implemented conformist, innovative, ritualistic, renunciative and rebellious adaptation strategies. Returning to the issue of ethos, the assumption of potentially conflicting roles also appeared when it came to alternatives generated within scientific groups or communities of scientists. The individual, he held, was faced with two alternatives: respect a scale of priorities, or implement deviant behaviour, the latter favoured possibly by the malfunctioning of mechanisms of social control. For Merton, deviance was not necessarily normal or inevitable within these groups. His analyses of science, in particular, as discussed above, those on the ethos of science, may be deemed insufficient, limited to the world of academia; and, when revisited, incapable of demonstrating “possible and true alternatives to its own interpretation” (G. Rinzivillo, 2019, p 81). However, they remain classics at international level and remain topically disruptive. The physiognomy of contemporary science, also known as “science 2.0”, post-academic science, transformed by the IT revolution, is characterised, on the one hand, by pressures favouring the privatisation and commercialisation of results, on the other, by strong avocation of open publishing, with the creation of digital archives and journals fostering the free circulation of research results. Works *in progress* are also shared and are consultable on a daily basis. This might produce potentially dysfunctional effects, Merton would say, for science as a whole, but reference to the Mertonian ethos of

communitarianism remains undisputed and strong. Another element to consider is the globalisation of research which calls into question the Mertonian ethos which is so deeply rooted in Western civilisation and its tradition. The industrialised West is no longer the only environment of reference for scientific research since other countries, China, in particular, have brought into play highly articulated and massive advancements within the realm of science in all areas. In addition, the pandemic at present gripping the entire planet, has triggered a renewed effort on the part of local and global scientific communities to find suitable drugs and/or create a vaccine. This emergency and its dramatic novelty will also give rise to innovations in research laboratories and will undoubtedly become a matter for investigation by the history and sociology of science in the near future, provided the validity of practicing them is still acknowledged.

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