# Robert K. Merton: between a universalist vision of science and a procrustean framework

## Robert K. Merton: entre uma visão universalista da ciência e uma estrutura fechada do conhecimento

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**ABSTRACT** Robert K. Merton (1910-2003) is generally perceived as the father of the sociology of science. In our article we will present the major claims of Merton's classical analysis of the 17th century origins of English science and the important gaps in this study. The content of Merton's famous scientific norms will also be summarized accompanied by discussion of their alternative and contradictory meaning. Finally, we present the concept of the "Mathieu Effect" and its connections with organisational stratification in science. Our analytic perspective is built on the idea that Merton's sociology is constructed on a procrustean "framework" whose closed logic is "inclusion" and "exclusion" of a restricted list of social values and institutions. His understanding of science is consequently very static, and as indicated above, absent of cognitive considerations.

**Key words** autonomy, norms, epistemology.



**RESUMO** *Robert K. Merton (1910-2003) é considerado como fundador da Sociologia da Ciência. Neste artigo apresentamos pontos centrais das análises clássicas de Merton sobre as origens da Ciência Moderna na Inglaterra durante o século XVII, indicamos também algumas lacunas de suas observações. O conteúdo das chamadas normas científicas de Merton serão sumarizadas e acompanhadas de comentários e alternativas a partir de alguns significados contraditórios. Finalmente trabalhamos com a idéia de um "Mathieu Effect" e suas conexões com a estratificação da própria organização das Ciências. Nossa perspectiva analítica sustenta-se na idéia de que a sociologia de Merton se constituiu a partir de estruturas muito fechadas, na qual há uma lógica rígida de exclusão e inclusão de valores sociais e institucionais. Seu entendimento da Ciência era, consquentemente, muito estático e carente de considerações cognitivas.*

**Palavras-chave** *autonomia, normas, epistemologia.*

Why should one today be interested in examining Robert K. Merton's work in the sociology of Science carried out between almost eighty and forty years ago? The answer is straightforward: study of the architecture and direction of the research programs and of the research findings of our intellectual forerunners provide a resource for reflection on key structures of our own work and on transformations that separate the forerunners from us. In line with this, it is useful to ponder the themes of: 1. Researchers' decisions concerning their topic of investigation, the evidential grounds viewed by them as sufficient for advancing claims, and the selection by researchers of their epistemological stance. 2. The degree and nature of the fit between the research question and methodology brought to bear on the question. 3. Finally with reference to the history and sociology of science corpus and community, the distance travelled between Merton's pioneering efforts in the decades bracketing the mid 20th century and the characteristics of our research efforts today. What has been gained since Merton' investigations, and precisely what has been lost? We will return to this central issue in the conclusion of this article.

The principal contributions of Merton fall into four categories. His best-known, and historically most important contribution dealt with the social and intellectual conditions that accompanied the birth of English 17th century "modern science". Foundational both to historical and more particularly sociological research, Merton proposed a set of norms he

judged essential to scientific enquiry and to the scientific community. Connected with this theme, he reflected on the societal values that constitute preconditions for the survival and prosperity of scientific research, with particular attention to the situation of science in totalitarian regimes. Finally, Merton explored science's internal organisation with specific attention to science's differential system of recognition and rewards. With few exceptions, the great majority of Merton's can be placed in these orientations.

The epistemology of Merton is entirely "differentiationist" to borrow the vocabulary of T. Shinn and P. Ragouet. Merton's analysis of the intellectual and organizational structures posits a total discontinuity between all things associated with science on the one hand, and on the other non-science matters of science such as politics, economics public opinion etc. He constantly insisted that science is autonomous from non-science considerations, and that science's very survival depends on such acute autonomy. It was from this differentiationist epistemology that Merton reached the observations that science possesses its own distinctive and distinct set of intellectual and community professional norms and that is continuation hinges on a specific set of social values. This differentiationist epistemology made it impossible for Merton the think in terms of relations with society, even of the sort that would allow science to import selective elements. In this same logic, Merton rejected a link between science and engineering. One of Merton's disciples, William Kornhauser, who carried out a study of the norms of industrial engineers, argued that academic scientists and industrial engineers contrast in countless way.[1]

Robert Merton's epistemology is also characterized by an anti philosophical bent. His writings are entirely silent on questions related to the descriptions of cognition or reflection on cognition. It may safely be said that his notion of science did not incorporate scientific thought. This closure to the philosophy of science may in part explain his failure to examine the constantly changing nature of scientific learning. Be this as it may, Merton's epistemology certainly contributed to his highly static treatment of science and to the unfortunate absence of the introduction of a dynamical component in his analysis.

The elements constitutive of Merton's work comprise a kind of highly polarised intellectual "framework":



Merton's sociological exploration of science as social organization authorizes certain parameters and de-legitimates others. It constitutes a highly structuring logic and framework, neither to be violated nor questioned. The framework comprises a space for description and understanding. It is arranged along two axes – one exclusionary and the other inclusionary. The one detrimental to the growth of science, the other propitious to science's development. The frame is thus polarized. In the work of Merton there is no place for interaction between inclusionary and exclusionary factors, nor are they historically defined or explored. It is entirely a-historical and devoid of any form of dynamic that might introduce a dialectical force or movement. The Mertonian framework for the assessment of science as social organization thus smacks of structural rigidity. Under the rubric inclusion one sees considerations of deviation, innovation, debate, democracy, hierarchy/stratification, social recognition, rewards, cumulative advantage, norms of science, and technology. As regards exclusion, one finds concerns of dogmatism, dogma unquestioned established authority, censorship, passivity, totalitarianism, evolution in the social organization of science, cognition, cognitive renewal, the rise of new disciplines, and interaction between social and cognitive organization. In the case of these exclusionary elements, the opening items of the list deal with forces that inhibit science, while the latter items designate paths of investigation rejected or ignored by Merton, and that are thus excluded from his research.

While Robert K.Merton is frequently said to be the father of the sociology of science, this lofty claim may be reasonably contested. Strictly speaking it is not true that Merton is the first sociologist of science. Before him, Karl Manheim (1893-1847) and Ludwig Fleck (1896-1961) published penetrating social analyses of the social and also the intellectual operations of contemporary science. Manheim was a sociologist and has been identified by some as an early sociologist of science. He introduced the concept of an utopian scientific social class who possessed the social values and intellectual ressources that would allow it to produce valid scientific knowledge, even in an indifferent or hostile social or cognitive environment. Here, science is precisely the monopoly of a specific social group, and the existence and operation of science is not contingent on the establishment or existence of a system of social and institutional

preconditions. As we will see, this runs exactly counter to Merton's view. For his part, Ludwig Fleck, a Polish medical doctor, biologist and sociolgist introduced already in the 1930's, the concept of thought collective which anticipate the theory of scientific paradigm advanced by Kuhn in 1962 and the episteme of Foucault. Fleck argued that the focus of cognitive content is affected by the orientation of the broader social environment. This runs counter to Merton's claim that science is entirely autonomous from society and must necessarily remain so to be effective.

In Merton's ground breaking and perhaps his most cited work, *Science, technology and society in 17th century England* (1938)[2], the author identified two principal causes for the institutionalization of science. He pointed to the acceleration of technology during this period due to enhancement in commerce, to proto industrialization and to the stimulus spawned by a succession of military conflicts. War called forever-increasing innovation in fire arms that spelled technical breakthroughs in weapony, explosives and metallurgy. Military and commercial navigation likewise provided stimulation for modification in naval architecture and ship fittings and construction techniques. The mechanical arts likewise benefited from the social and political opportunities of 17th century England. Merton gave considerable attention to painting the technical backdrop of the rise of science. He perceived here precisely how social forces may provoke or bar scientific development. The rise of science, he claimed, is largely dependent on such exogenous factors[3]. In the case at hand, technology both offered scientists novel equipment and instruments useful to scientific investigation. Conversely, advances in science fed back into the current of technological change of the day. In these arguments Merton solidly anchored science both in considerations material and societal. He thusly stressed that science is necessarily intelligible in terms of its social context and cannot be separated from such.

Factors of class, education and above all belief-related practices linked to Puritanism constitute the second causal current. England was predominantly an Anglican country. Religious reformers composed a small fraction of the population. In a study of the religious affiliation of 17th century English natural philosophers, Merton discovered that a sizable majority were Puritans. He determined that the social composition, education and belief-related practices of Puritans differed significantly from Anglicans, and that these differences corresponded to certain functional inclination associated with the social organization of science. Here one discerns huge debt that Merton to Max Weber's monumental study – *The protestant ethic and the spirit of capitalism*[4]. This overlap between Merton and Weber can be no accident and Merton's indebtedness to Weber is perhaps not adequately indicated by Merton in his study. Indeed it is that segment of Merton's explanation of the rise of science connected with Puritanism that has far become the most cited passage of his work.



The individual represents the heart of Puritanism. The individual is directly connected to God. Unlike Catholicism and Anglicanism, the priesthood does not mediate between the believer and the deity. Individuals are accountable for reading and interpreting the Bible. The individual is paramount in the interpretation of the texts. Texts are interpreted on the basis of rationality. There is no place for higher authority or dogma here.

Of utmost importance, God is viewed as the creator of nature, and to worship God is synonymous with nature. The study of the physical world thus merges with the worship of God. Through this concatenation, Puritans came to see themselves as responsible for the investigation of the laws of nature as an expression of God's workings.

When taken together, this combination of considerations paved the way for science by offering a favorable intellectual, educational and professional environment.

For Merton it is sufficient to understand the rise of science as an institutionalized social organization in terms of social factors. It is unnecessary to look for the roots of science in the domain of philosophy or epistemology. While, according to Merton, reflection on nature and its study predate the 17th century, science per se waited the occurrence of a series of positive social currents.

It is instructive to compare the analysis of the historian of Peter Sorokin (1889-1968) with Merton in terms of appreciation of epistemology and historical change in science.

Peter Sorokin directed Merton's Harvard doctoral dissertation. In one of his books Sorokin advanced the theory for the historical development of science in which he drew attention to three factors: 1. Invariances which is expressed both on the cognitive and the cultural plan, the concept of "logical consistency"; 2. A strong emphasis on cognition per se; 3. A tacit recognition of the centrality of epistemology and an inclination toward ontological position. The invariance outlined by Sorokin refers to three categories of human relations to the world "ideational" (religion), "sensate" (experiential), and "idealistic" (abstract and mathematical). The prevalence of each one of these categories in a historical period determines the tonality of a culture, the emergence of particular research themes and the development of specific techniques and methods for treating selected subjects. The rejection by Merton of this invariance, cognition and ontology colored much of his work. It circumscribed his approach to the study of the origins of science, where there is no mention of things cognitive, and where culture considerations are reduced to fragmented strictly sociological considerations.

## Democracy and CUDOS

The article entitled "Science and the social order", may be regarded as a militant pamphlet against totalitarianism and in favor of democracy-based science. Published in 1938, it is largely oriented against the nazi regime[5]. In this article Merton shows that science can be undertaken in regimes such as nazism, but where it is maintained or forested only when it serves the purposes and interests of the regime. He also argues that science is radically separated from the public which is maintained in an irrational and uninformed state and which rejects all forms of intellectual activity. It is worth noting that in this essay Merton presents no supportive evidence. One finds here a succession of affirmations and opinions.

In 1942 Merton published his second groundbreaking text, "Science and technology in a democratic order"[6]. Here Merton proposed that science incorporates four foundational perspectives/attitudes. "Cosmopolitanism", "Universalism", "Disinterestedness", and Organized Scepticism" comprise the elements. As will be addressed below, the status of these norms in science for Merton remains unclear. This is worrying as their status is of great importance for the understanding of science.



1. Cosmopolitanism: In science, discoveries and learning are not the private property of the individual who developed them. They are instead the common goods of the entire community and all are free to use the findings untrammelled. The concept and legal status of "intellectual property" are absent from science.

2. Universalism: The validity of knowledge claims is grounded on critical intellectual criteria. Elements such as social class, religion, race and nationality do not figure in determining the validity of scientific findings.

3. Disinterestedness: Science is impersonal.

4. Organized scepticism: Knowledge claims are carefully scrutinized in science. Nothing is taken for granted. Established authority is not sufficient to ground a claim. Critical alertness is omnipresent.

The operational mechanism of these norms as intended by Merton is unclear. Three principal interpretations are credible. 1. The norms describe the scientific community. They distinguish it from other groups and professions. In this scenario they do not govern activities but rather indicate the configuration of the community. 2. The norms constitute a kind of an ideal type that enlightens the actions of individual scientists. They provide a point of reference. Here they function both as discourse and as a marker but they are not binding. 3. The norms represent a stringently imposed norm to which scientists comply. Obedience is ensured through sanctions. This third scenario would imply that the individual scientist integrates the norms and that they guide the desiderata of research practice.

## The Matthew effect

In two articles that deal with what Merton terms the "Matthew Effect", the first published in 1962 and the second appearing a few years[7], the author focuses on psycho-sociological processes that affect the allocation of rewards to scientists for their contributions, and with the flow of ideas through the communication system of science. The rewards for original well done work by one scientist takes the form of recognitions offered by fellow researchers. Scientists benefiting from high citation rates for their work tend in the future to continue to be highly cited when compared to the citation levels of people who had not earlier been much cited. Stated differently, this signifies that highly recognized researchers tend to maintain an elevated level of peer recognition independent of future activities. The recognition they continue to receive is a carry over from earlier highly cited endeavours. For example, if a seriously recognized person co-signs an article with less well-known colleagues, it is the name of the ranking scientist who is automatically associated with the new publication rather than the names of his collaborators. In brief, there operates a system of "cumulative rewards and recognition" to adopt the terminology of Merton. Based on a passage from the Bible, Merton refers to this as the "Matthew effect": "For to everyone that hath shall be given, and he shall have abundance: but for him who hath not shall be taken away even that which he hath". In other words, the accruing of greater increments of recognition for scientists who already have considerable reputations, and the withholding of recognition for scientists who have not made their mark. Merton goes on to suggest that recognition and rewards are coupled to sundry factors such as the ranking of a department and its university in the institutional hierarchy, the prestige of the journal in which a person publishes etc. He also points to the fact that through a mechanism of legitimation by association the simple signature of a well known person on an article is capable of making the scientific assertion contained therein an important and broadly received idea. In this respect, cumulative advantage affects the content of science proper. Nevertheless, this conjunction between intellectual and social considerations constitutes the unique case of such interaction, or at best one case of only a handful proposed by Merton. The above expressed lament that Merton indeed neglects or refuses to interrogate topics touching on cognitive/social dynamics thus stands.



The reinforcement of those "privileged" by the system of science which itself has promoted (promised) them and maintained their position, and which similarly determine inclusion and exclusion members of the scientific community in the strata of power and recognition, based on their membership and adherence to norms. He who is in the highest strata (elite) thanks to multiple factors from which he benefits, cannot but perpetuate them, and strengthen the frontier which protects them; he who has been excluded from these privileged stratum remains outside the rewarding system, and is stuck within a lower stratum from which there is no hope to escape.

Merton here gives a social framework which has some influences on the content of scientific activity. And if one can highly regret that he did not produce on going analysis on this important question, one can at least consider the merit of his endeavor to explore and determine this framework. We will later come back to this point.

In this article Merton also discusses the symbolic operation of intellectual property in the research process. In science, wealth constitutes the stock of knowledge while income takes the form of peer acknowledgement of that learning. It is only through making research results public to other scientists that an individual can obtain the property rights to his findings. Stated otherwise, this means that exclusively through going public can an individual generate entitlement to his private work. On the symbolic level, income is obtained from this public property only when other scientists acknowledge its utility in the form of citing it in their own publications. By so doing, they purchase the property offered by the innovative researcher. In this analysis Merton bases his thinking on the principles of capitalistic exchange, but in certain respects turns the logic on its head. This passage of the article is interesting because for once Merton introduces symbolic elements into his considerations of the science system. It is unfortunate that he did not carry this line of highly productive thought a bit further. Indeed it was Pierre Bourdieu who more fully articulated the concepts of different forms of capital in science, and particularly symbolic capital is his epoch-making publications of 1975[8] and 2001[9].

## Merton's disciples – Hagstrom, Cole and Cole, Ben-David

The French sociologist Michel Dubois[10] has introduced the idea of two circles of mertonians: the work of Warren Hagstrom and the brother Jonathan and Steven Cole are emblematic of the mertonian inspired research of the first circle. Hagstrom[11] is particularly noteworthy and indeed warrants more attention than will be accorded to him here for his highly nuanced and interesting use of concepts introduced by Marcel Mauss, the "gift" and "counter-gift" (don et contre-don)[12]. His purpose is to link the scientific production process to exchange of gift and conter-gift inside scientific communities sub-sets.

For their part, Cole and Cole[13] belong to a functionalist conception of the origins of social inequality inside science. Their goal was to show a relationship between what they call a "social need" inside science, that is to say to react to and enhance knowledge, and the differences between the degrees of recognition that they receive. Cole and Cole offer reply to the following question: is it the case that the unequal distribution of individuals inside the stratified structure of science can be explained by inequalities in the social organization and hierarchies of scientific structures and activities?

Based on a sample of physicists in 58 different university departments, they examined scientists with reference to age, the standing of the university department, productivity, prizes and a measure of the "social quality" of publications based on the *Science Citation Index*.

One sees here an example of measurement of the position and rank of individuals inside a normative social system which defines itself and at the same time defines what is measured.

This constitutes an extension of Merton's orientation where impenetrable walls separate the cognitive content and a highly normative context in which it is done. The stratification of Cole and Cole is a reinforcing system of the context which fixes the position of individuals.



In the second circle of mertonian disciples the case of Joseph Ben-David (1920-1986) merits particular attention. As does Merton, Ben-David elaborates the concept of role in science. Of utmost significance, he succeeds in connecting the notion of role to cognition. Ben-David notably generates an innovative concept termed "role hybridization" in which he designates two kinds of roles: 1. an intellectual disciplinary role, and 2. a professional institutional role. In this context, an individual conducting research in an intellectually prestigious domain which nevertheless offers no opportunity for professional advancements quits the discipline moving to an institutionally promising but cognitively inert field. He gains professional prestige at the cost of intellectual stagnation[14]. For example, Wilhelm Maximilian Wundt (1831-1920) who initially conducted research in physiology where there was little possibilities of professional advancement, but where there was considerable intellectual prestige, chose to transfer to the discipline of philosophy where there existed many professional institutional possibilities, but which lacked cognitive prestige. He soon became discontent with his state of cognitive closure. He resolved the paradox through "role hybridization", first by entering a branch of philosophy, psychology, and then by creating the new discipline of experimental psychology which bridged philosophy and the experimental methods and precision of physiology[15].

Ben-David's approach deviates considerably from that of Merton whose perspective revolves around a static interpretation of roles in the status, production of science and in the context of individual's insertion and assimilation in their scientific community.

## Conclusion

In the 1970's non-orthodox yet Mertonian minded sociology emerged whose principle authors were for some years synonymous with the publication vehicle – the sociology of a *Sciences Year Book*. The best known among these authors

include R. Whitley who differentiated science from other professions in terms of the centrality of "reputation" which he termed a "reputation organisation"[16]. He also distinguished between science disciplines in terms of the structure of science research tactic and strategies and in terms of the degree of technological propositional uncertainty. Other sociologists include Peter Weingard who studied change in science in terms of relations between scientific applications and basic science. Still others saw science in terms of an autopoietic system.

It is important to say in favour of Merton that he sought to provide a very rigorous and structured framework and vocabulary for the study of the organisation of science. This greatly contrasts with too much of the research in the philosophy and sociology of science today which fails to identify a precise position of different actors inside science, on the edge of science, and in a range of complex and heterogeneous relationships between science, politics and economic interests, and citizen groups. Today we sadly see a terrible mixture in the perception of what is taking place in science laboratories and anti-science groups, politics and science policy and a uninformed public opinion.

## Notas e referências bibliográficas

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