



Journal of EVOLUTION & Technology

A peer-reviewed electronic journal
published by the [Institute for Ethics
and
Emerging Technologies](#)

ISSN 1541-0099

17(1) – March 2008

Making Science by Serendipity. A review of Robert K. Merton and Elinor Barber's *The Travels and Adventures of Serendipity*

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Journal of Evolution and Technology - Vol. 17 Issue 1 – March 2008- pgs 75-83
<http://jetpress.org/v17/campa.html>

Robert K. Merton and Elinor Barber's *The Travels and Adventures of Serendipity* (English-language translation 2004) is the history of a word and its related concept. The choice of writing a book about a word may surprise those who are not acquainted with Merton's work, but certainly not those sociologists that have chosen him as a master. Searching, defining, and formulating concepts has always been Merton's main intellectual activity.

It is somewhat of a ritual among Merton's commentators to thank him for the numberless concepts with which he has furnished sociological research. Barbano (1968: 65) notices that one of Merton's constant preoccupations is with language and the definition of concepts and recognizes that the function of the latter is for him anything but ornamental. Sztompka (1986: 98) writes that "the next phase chosen by Merton for methodological discussion is that of concepts-formation. Achieving clarity, precision and unambiguous meaning of sociological concepts seems to be an almost obsessive preoccupation."

What should be clear is that he does not formulate concepts by chance. Many sociologists formulate important concepts by building a new theory of society, but this is not what Merton does. He completely renounced the building of his own total system of theory and did not even spend so much time in trying to elaborate theories of the middle range. He has dedicated almost all his time to concept-formation. This is why he has not given us only *some* concepts but *many*. Merton proposes an articulated technical language now widely used by sociologists and is perfectly aware of the strategic importance of this work.

The following quotation can be seen as evidence of his awareness of the heuristic power of concepts:

As we have seen, we experience socially expected durations in every department of social life and in a most varied form. [...] That ubiquity of phenomenal SEDs may lead them to blend, conceptually unnoticed, into the taken-for-granted social background rather than to be differentiated into a possibly illuminating concept directing us to their underlying similarities. As Wittgenstein once observed with italicized feeling: “*How hard I find it to see what is right in front of my eyes!*” (Merton 1996: 167.)

Of course, we did not have to wait for Wittgenstein or Merton to understand the importance of words to the scientific and philosophical discourse. It had been realized already in Medieval times that *talia sunt objecta qualia determinatur a praedicatis suis*. But then again, as Whitehead used to say and Merton (1973: 8) used to repeat: “Everything of importance has been said before by someone who did not discover it.”

If Merton and Barber invested energies in writing the history of a word, I feel it now necessary to write a few words about the history of their book. The travels and adventures of the book are not less fascinating than the content of the book itself. It was in the 1930s that Merton first came upon the concept-and-term of serendipity in the *Oxford English Dictionary*. Here, he discovered that the word had been coined by Walpole, and was based on the title of the fairy tale, *The Three Princes of Serendip*, the heroes of which “were always making discoveries by accidents and sagacity, of things they were not in quest of.”

The discovery of the word was serendipitous as well, since Merton was not looking for it. In this sense, it was self-exemplifying. The word could not fail to trigger him, considering that at the time he was busy with the foundation of the sociology of science – more precisely and quite significantly with the elaboration of a sociological theory of scientific discovery (Merton 1973: 281 et seq.) – and with the formulation of the idea of the unanticipated consequences of social action (see Merton 1996: 173 et seq.). As Rob Norton (2002) recognizes: “The first and most complete analysis of the concept of unintended consequences was done in 1936 by the American sociologist Robert K. Merton.” In this way, the combined etymological and sociological quest began that resulted in *The Travels and Adventures of Serendipity*.

Initially, the book was conceived as a “*preparazione OTSOGIA*.” In other words, it was to serve as a propedeutic to Merton’s seminal work – *On the Shoulders of Giants*, acronymised to OTSOG and published in 1965. Nonetheless, after completion in 1958, the book on serendipity was intentionally left unpublished. Probably the authors had the impression that when finished the book had lost some of its novelty. And the situation got “worse” year after year. We find some information about it in the long and insightful afterword written by Merton just prior to his death (in my modest opinion, one of the most interesting parts of the book). In it, Merton provides interesting statistics to illustrate how quickly the word had spread since 1958. By that time, serendipity had been used in print only 135 times. But between 1958 and 2000, serendipity had appeared in the titles of 57 books. Furthermore, the word was used in newspapers 13,000 times during the 1990s and in 636,000 documents on the World Wide Web in 2001.

In any case, the book was occasionally and most tantalizingly cited in Merton’s other publications. In 1990, OTSOG was translated into Italian and published with an introduction by Umberto Eco. The Italian publisher noticed a footnote mentioning the existence of the still unpublished *The Travels and Adventures of Serendipity* and proposed its publication in Italian.

The authors agreed to an Italian translation, but Merton posed the condition that it had to be enriched by a long afterword. The translation was quickly made, but the publisher had to wait a decade to have the long and precious *appendice*. The reason for such a delay was the many ailments that Merton had had to battle with before his death. The Italian version was published in 2002, after Barber's death. Two years later and a year after Merton's death, we could welcome the appearance of the original English version.

Now let us focus on an analysis of the content of the book and its theoretical consequences, that is, on the history of this term-and-concept and its significance to the sociology of science. The first few chapters elucidate the origin of the word, beginning with the 1557 publication of *The Three Princes of Serendip* in Venice. This is a story about the deductive powers of the sons of the philosopher-king of Serendip. However, the princes did not have their adventures in Serendip but in neighboring lands, and the king is named Jaffer. The modern association of Sri Lanka with serendipity is therefore erroneous (Boyle 2000).

In a letter to Horace Mann dated January 28, 1754, Walpole described an amazing discovery as being "of that kind which I call Serendipity." He went on to provide his succinct definition but then blurred it by providing an inadequate example from *The Three Princes*: "As their highnesses travelled, they were always making discoveries, by accident and sagacity, of things which they were not in quest of: for instance, one of them discovered that a mule blind of the right eye had travelled the same road lately, because the grass was eaten only on the left side, where it was worse than on the right – now do you understand serendipity?"

Walpole tried to illustrate the concept of serendipity with other examples, but basically failed to do it in an unequivocal way. After many decades, in 1833, Walpole's correspondence with Horace Mann was published. Through this and other editions of the letters, the word serendipity entered into the literary circle.

Merton and Barber do not fail to study and emphasize the social and historical context that permits the acceptance and diffusion of the neologism. The nineteenth century is the century of industrial revolution. It is a period of extraordinary expansion for science and technology, marked by the foundation of numerous new scientific disciplines, sociology included. As the authors (2004: 46) remark: "It is in the nature of science that new concepts, facts, and instruments constantly emerge, and there is a continual concomitant need for new terms to designate them. With the accelerated pace of scientific development in the nineteenth century, the need for new terms was frequently felt and as frequently met by the construction of neologisms. Scientists had no antipathy to new words as such: hundreds and then thousands were being coined..."

Serendipity was used in print for the first time by another writer forty-two years after the publication of Walpole's letters. Edward Solly had the honor of launching serendipity into literary circles. He signed an article on *Notes and Queries*, a periodical founded in 1849 by the learned bibliophile William John Thoms. Solly defined serendipity as "a particular kind of natural cleverness". In other words, he stressed Walpole's implication that serendipity was a kind of innate gift or trait. However, Walpole was also talking of serendipity as a kind of discovery. The ambiguity was never overcome and serendipity still indicates both a personal attribute and an event or phenomenon. It's worth noting that after the first appearance in print, "[f]or more than fifty years, serendipity was to be used almost exclusively by people who were most particularly concerned with the writing, reading, and collecting of books" (Merton and Barber 2004: 48).

From the turn of the twentieth century, serendipity gained acceptance for its aptness of meaning among a wider and more varied literary circle and the word appeared in all the “big” and medium-sized English and American dictionaries between 1909 and 1934. Its 1951 inclusion in the *Concise Oxford English Dictionary* was of equal importance as it reflected the higher probability of the casual reader encountering the word as it filtered down from academia. Moreover, the word passed from the Oxford English Dictionary into Merton’s personal vocabulary.

When outlining the lexicographical history of the word the authors reveal disparities in definition (see Merton and Barber 2004: 104-122 and 246-247). In 1909 the word is defined by *The Century Dictionary* as “the happy faculty or luck of finding by ‘accidental sagacity’” or the “discovery of things unsought.” But the double meaning disappears in the 1913 definition provided by *Funk and Wagnall’s New Standard Dictionary of the English Language* where serendipity is uniquely “the ability to find valuable things unexpectedly.” In addition, in the *Swan’s Anglo-American Dictionary* (1952), serendipity is just an event and no more a personal attribute: “the sheer luck or accident of making a discovery by mere good fortune or when searching for something else.” To avoid both the ambiguities of the meaning and the disappearance of one of the meanings, Piotr Zielonka and I (2003) decided to translate serendipity into Polish by using two different neologisms: “serendypizm” and “serendypicja” – to refer to the event and the personal attribute respectively.

The disparities in definition also concern other aspects. While the *Century Dictionary* was stressing the role of sagacity, *The Oxford English Dictionary* in 1912-13 does not mention this aspect and defines serendipity as “the faculty of making happy and unexpected discoveries by accident”. Other definitions do not meet Walpole’s prescription of a gift for discovery by accident and sagacity while in pursuit of something else. These incomplete definitions have resulted in the wrong belief that “accidental discovery” is synonymous with serendipity.

Even if Merton waited four decades to publish his book on serendipity, he made wide use of the concept in his theorizing. In 1946, Merton revealed his concept of the “serendipity pattern” in empirical research, of observing an unanticipated, anomalous, and strategic datum, which becomes the occasion for developing a new theory. In this way Merton contributes to the history he maps out.

It is worth now turning our attention to the theoretical aspects of serendipity and examining the sociological and philosophical implications of this idea. In the 1930s, by facing the problems of the newly born discipline called the sociology of knowledge, Merton works to eliminate some lacunas left by his predecessors. In a similar way to Ludwik Fleck (1979), Merton is convinced that no reason impedes considering the so-called hard sciences as subject matter for the sociology of knowledge. The sociology of knowledge cannot limit its subject matter to the historical, political and social sciences. This is the frontier reached by Mannheim, but the American sociologist holds that it is necessary to go further. “Had Mannheim systematically and explicitly clarified his position in this respect, he would have been less disposed to assume that the physical sciences are wholly immune from extra-theoretical influences and, correlatively, less inclined to urge that the social sciences are peculiarly subject to such influences” (Merton 1968: 552). Thanks to this new awareness, the sociology of science came into existence. As Mario Bunge (1998: 232) remarks, “Merton, a sociologist and historian of ideas by training, is the real founding father of the sociology of knowledge as a science and a profession; his predecessors had been isolated scholars or amateurs.”

Certainly, the sociology of science has subsequently evolved in new directions, not all predicted by his father. The most common accusation leveled against Merton is that he has never really studied the impact of society upon science, intended as a cultural and cognitive product. He has concentrated his attention on institutions and norms, and neglected epistemological problems. Consequently, it is now common to distinguish between two programs in the sociology of science: the “weak,” pursued by Robert Merton and the Mertonians, which concerns the study of institutions and, thus, produces epistemologically irrelevant results; the “strong,” pursued by David Bloor (1976) and the sociologists of the new generation, which concerns the study of the contents of science and, thus, produces epistemologically relevant results.

It is true that the American sociologist studies mainly institutions of science, not laboratory life and the products of science (e.g., theories). But he never said that sociologists *cannot* or *should not* study other aspects of science. His attention to the concept of serendipity is the best evidence of parallel attention to the very content of scientific discoveries and the way they are made. “Since it is the special task of scientists to make discoveries, they themselves have often been concerned to understand the conditions under which discoveries are made and use that knowledge to further the making of discoveries. Some scientists seem to have been aware of the fact that the elegance and parsimony prescribed for the presentation of the results of scientific work tend to falsify retrospectively the actual process by which the results were obtained” (Merton and Barber 2004: 159). The authors present a considerable number of quotations showing that many scientists, historians and philosophers of science have been aware of the fact that scientific inquiry cannot be metaphorically represented as hunting a hare (searching for a specific applicable scientific theory) with a rifle (the rules of scientific method). Indeed if you are clever enough to take advantage of the opportunity, you may capture a fox thanks to accidental circumstances while searching for hares.

The authors also do not fail to present the resistance to the idea of serendipity. For orthodox Marxists, scientific and technological discoveries are a product of necessity. The slavery mode of production does not need machines, while the capitalistic mode of production needs them. Thus, the industrial revolution of the eighteenth century is related to the development of physics and the invention of machinery. “To orthodox Marxists, the suggestion that discoveries could be occasioned by accidents rather than by the inexorable development of the material base of society was anathema. Since the Marxists believe that all social and physical phenomena are rigidly determined, inventions are, in principle, predictable, and the job of the historian or philosopher of science is to work out ways of predicting them” (Merton and Barber 2004: 166). However, by using the adjective “orthodox”, the authors implicitly recognize that not all Marxists share this rigidly deterministic view of social and natural reality.

Even if Merton did not publish his monographic work on serendipity until 2004, he has constantly referred to this category in his theoretical work. In another writing, for instance, he makes the step from description to prescription:

historians and sociologists must both examine the various sorts of “failure”: intelligent errors and unintelligent ones, noetically induced and organizationally induced foci of interest and blind spots of inquiry, promising leads abandoned and garden-paths long explored, scientific contributions ignored or neglected by contemporaries and, to draw the sampling to a close, they must examine not only cases of serendipity gained but of serendipity lost (as with the many instances of the antibiotic effects of penicillin having been witnessed but not discovered). (Merton 1975: 9.)

The Baconian and positivist dream of elaborating a set of methodological rules capable of also opening the door to scientific discovery to people of modest intelligence and sagacity cannot be better challenged than by the idea of serendipity. Columbus' discovery of America, Fleming's discovery of penicillin, Nobel's discovery of dynamite, and other similar cases, prove that serendipity has always been present in research. Merton (1973: 164) emphasizes that: "Intuition, scriptures, chance experiences, dreams, or whatever may be the psychological source of an idea. (Remember only Kekulé's dream and intuited imagery of the benzene ring which converted the idea of the mere number of atoms in a molecule into the structural idea of their being arranged in a pattern resulting from the valences of different kinds of atoms.)" In this, Merton seems to be very close to Bachelard, Popper, Bunge, and the neorationalists in general. Bachelard (1938), for example, emphasizes the importance of abstraction as the only way to approach scientific truth. The Popperian idea that theories come from the sky is well known. Finally, one of the most systematic studies of intuition in science has been proposed by Mario Bunge (1962).

However, Merton does not consider the problem of methodology solvable with the elimination of the context of discovery and the improvement of the context of justification. The problem of discovery is what Oldroyd (1986) would define as the ascending part of the arch of knowledge – from the object-level to theory – that cannot be settled by merely replacing induction with intuition/invention, as Popper suggests. It is still both possible and worthwhile to study this problem from a psychological and sociological point of view. The *serendipity pattern* is Merton's proposal to attempt to complete the hypothetical-deductive model, which is a logical model, and so fails to describe much of what actually occurs in fruitful investigation.

The serendipity pattern refers to the fairly common experience of observing an *unanticipated, anomalous and strategic* datum which becomes the occasion for developing a new theory or for extending an existing theory... The datum is, first of all, unanticipated. A research directed toward the test of one hypothesis yields a fortuitous by-product, an unexpected observation which bears upon theories not in question when the research was begun. Secondly, the observation is anomalous, surprising, either because it seems inconsistent with prevailing theory or with other established facts. In either case, the seeming inconsistency provokes curiosity... And thirdly, in noting that the unexpected fact must be strategic, *i.e.*, that it must permit of implications which bear upon generalized theory, we are, of course, referring rather to what the observer brings to the datum than to the datum itself. For it obviously requires a theoretically sensitized observer to detect the universal in the particular. (Merton 1968: 157-162.)

The proposal of the serendipity pattern can be interpreted as a convergence toward Peirce's metascience. Merton (1968: 158) writes: "Charles Sanders Peirce had long before noticed the strategic role of the 'surprising fact' in his account of what he called 'abduction,' that is, the initiation and entertaining of a hypothesis as a step in inference." This pattern can be assimilated to Peirce's abduction, Thomas' *modus ponendo ponens*, or Galileo's reasoning *ex suppositione* (see Wallace 1981). One observes a fact F. This fact is surprising and cannot be explained with existing theories. Hence, stimulated by the problem, one formulates a new theoretical hypothesis T. If T were "true," then F would be obvious, therefore one has good reason to suspect that T is "true." Of course, this logical model does not actually guarantee the correctness of T, despite the fact that Thomas seemed to believe so. According to Merton, T remains a conjecture, which must be submitted to other social and rational procedures in order to be accepted as certified knowledge by the scientific community.

This descriptive model has many important implications for the politics of science, considering that the administration and organization of scientific research have to deal with the balance between investments and performance. To recognize that a good number of scientific discoveries are made by accident and sagacity may be satisfactory for the historian of science, but it raises further problems for research administrators. If this is true, it is necessary to create the environment, the social conditions for serendipity. These aspects are explored in Chapter 10 of *The Travels and Adventures of Serendipity*. Merton and Barber (2004: 199) underline that “[r]esearch administrators may be authoritarian or they may be permissive, they may see the interests of the individual scientists as being identical with those of the organization as a whole or they may not, and such preferences for relative autonomy and independence or for relatively rigid control may be refracted through the problem of the legitimacy or desirability of serendipity.”

The solution appears to be a Golden Mean between total anarchy and authoritarianism. Too much planning in science is harmful. The experience of Langmuir as a scientist in the General Electric laboratories under Willis Whitney’s direction proves the importance of the autonomy and fun of the individual researcher, together with the concern of the administrator. Langmuir decided autonomously to study high vacuum and tungsten filaments. Whitney supervised the evolution of the inquiry everyday but limited himself to asking: “Are you having fun today?” It was a clever way to make his presence felt, without exaggerating with pressure. The moral of the story is that you cannot plan discoveries, but you can plan work that will probably lead to discoveries:

To put Langmuir’s argument another way, dictatorship in the laboratory and the political sphere is as impractical as it is morally repugnant; it runs counter to what men of the eighteenth century would have called the “natural laws” of society in general and the world of science in particular. The policy of leaving nothing to chance is inherently doomed by failure: It flies in the face of human nature, and especially the nature of rational, independent scientists. (Merton and Barber 2004: 201.)

The peculiar thing about the serendipity pattern is that it weakens not only the Baconian, positivistic, inductivistic approach to knowledge, but also the opposite sociologistic, constructivistic and relativistic temptation to see the content of scientific theories as necessarily and fully determined by the social context. If scientists are *determined* by social factors (language, conceptual frames, interests, etc.) to find certain and not other “answers,” why are they often surprised by their own observations? A rational and parsimonious explanation of this phenomenon is that the facts that we observe are not necessarily contained in the theories we already know. Our faculty of observation is *partly* independent from our conceptual apparatus. In this independence lies the secret of serendipity.

The Travels and Adventures of Serendipity has rapidly gained the fame it deserves (see <http://www.pupress.princeton.edu/quotes/q7576.html>). Cristina Gonzalez, in *Science*, defines it as “A fascinating text that captivates the reader from the start.” Steve Shapin, in *American Scientist*, remarks that “It is a pity that we had to wait so long for it, since *The Travels and Adventures of Serendipity* is the great man’s greatest achievement.” According to Philip Howard, *The Times* (London), “This is the best written and most entertaining book of sociology ever written”. For the Nobel Laureate Roald Hoffmann, “Curiosity, wonder, openness – these cohabit, comfortably, in that marvellous coinage of Walpole, serendipity. And they mark as well Merton and Barber’s ebullient journey in search of all the meanings of the word. A romp of minds at play!” The review by the distinguished historian of science Gerald Holton is enthusiastic: “What a splendid book! *The Adventures and Travels of Serendipity* is not only a guide to the extraordinary history and present-day usefulness of the blessings that can come from those unplanned, accidental events

which, sagaciously employed, can shape one's life. But equally, the volume is an exemplification of superb scholarship presented in graceful style. Indeed, while reading the book one realizes that one perceives its unique subject matter from the vantage of standing on the shoulders of giants." Harold M. Green predicts that "*The Travels and Adventures of Serendipity* is destined to become a classic in the history and philosophy of science."

Robert K. Merton has been my master and before dying honored me by quoting my work in his universally praised masterpiece. This might be thought to have prejudiced me in favor of this book, thus I will not add my own praise to the long list presented above. I would only like to express my hope that Green's prophecy is fulfilled.

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