

## The intended consequences of Robert K. Merton

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Having recently written about the “unintended consequences” of Robert K. Merton,<sup>1</sup> it occurred to me that I am uniquely qualified to speak about the “intended consequences of Robert Merton” from the scientometrics perspective. Once I encountered Bob’s paper in the *New Scientist* about genius in discovery,<sup>2</sup> as well as multiples in discovery, and exchanged correspondence with him, I became increasingly curious to know more about him. As it turned out, citation indexing not only facilitated that learning process but also helped me better appreciate the extent of his impact on scholarship.

When the *Science Citation Index* was launched in 1964, we also started the Automatic Subject Citation Alert (ASCA) service which became available in 1965.<sup>3</sup> My personal search profile for this alerting service included Merton’s name as a cited author, so I was regularly informed of new papers that had cited his work. Every week for over 35 years, I have been stimulated by an amazing assortment of article titles whose authors have been influenced by his work – on average, about twenty papers per week! And the flow continues to this day. The breadth of their content reflects not only the diversity of his publications but also the applicability and power of his theoretical ideas as well as the diverse topics which were related to them but often times seemingly unrelated. Merton himself also received a similar weekly ASCA personal alerting report which he scanned with great interest. He had a routine procedure for marking titles for which his aide requested reprints. His reading was formidable.

These experiences with ASCA illustrate one of the most exciting facets of citation indexing. It is not only that one retrieves papers that can be judged to be logically connected to the cited work but in addition, the least expected connections might be made. That is why traditional measures of relevance need to be modified to judge the results of a cited reference search.<sup>4</sup> In my case, it has always been a special thrill to learn about a paper on a seemingly unrelated subject in which the author had cited one of my papers for a completely unexpected reason. You might say that these unanticipated consequences of a citation search were indeed “intended” yet they are

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serendipitous in that they could not be foreseen. When Julian Smith reviewed the *Science Citation Index* in 1964 he made this point and described the process as systematic serendipity.<sup>5</sup>

To further illustrate the point, consider the following subject matter mentioned in a sample of papers published in 2003 that have cited Merton:<sup>6</sup>

- 1) sociology of vindictiveness
- 2) criminology of transgression
- 3) collaborative education policy
- 4) adolescent deviance
- 5) marijuana using crack sellers
- 6) model for reduced food fat
- 7) teacher perceptions and expectations
- 8) racial patterns in school sports
- 9) the expanding universe
- 10) self-fulfilling influences of mother's expectations
- 11) models of power
- 12) no free lunch theories in automation
- 13) peer review
- 14) political party practices in India
- 15) the experience of stroke
- 16) tattooing in deviant behavior
- 17) corruption in China
- 18) priority role in science
- 19) coping with chronic illness
- 20) technological forecasting
- 21) youth suicide
- 22) ergonomics
- 23) gender in youth
- 24) co-responsibility of research integrity
- 25) box office success
- 26) fallibility of peer review

Another perspective on the variety of subject matter involved is to consider some of the journal names listed below – all outside the “expected” fields in which he was a direct participant.

Journals whose articles cited R. K. Merton 2002-2003:<sup>6</sup>

Arranged in order of citation frequency

#	Title
1	<i>Scientometrics</i>
2	<i>Social Studies of Science</i>
3	<i>Journal of Management Studies</i>
4	<i>Library Trends</i>
5	<i>Criminology</i>
6	<i>Science in Context</i>
7	<i>Administrative Science Quarterly</i>
8	<i>Journal of Documentation</i>
9	<i>Theoretical Criminology</i>
10	<i>Evaluation Review</i>
11	<i>Science and Engineering Ethics</i>
12	<i>Journal of Nervous &amp; Mental Disease</i>
13	<i>Minerva</i>
14	<i>Organization</i>
15	<i>Annals of Science</i>
16	<i>Public Understanding of Science</i>
17	<i>Canadian Journal on Aging-Revue</i>
18	<i>American Anthropologist</i>
19	<i>Social Networks</i>
20	<i>Work and Occupations</i>
21	<i>Psychology of Women Quarterly</i>
22	<i>Policy Sciences</i>
23	<i>Ethnic and Racial Studies</i>
24	<i>Post-Soviet Affairs</i>
25	<i>Journal of Consumer Research</i>
26	<i>Nursing Ethics</i>
27	<i>Stanford Law Review</i>
28	<i>Health Services Research</i>
29	<i>Cortex</i>
30	<i>Coastal Management</i>
31	<i>Paleobiology</i>
32	<i>Quality &amp; Quantity</i>
33	<i>Academic Medicine</i>
34	<i>Family Practice</i>
35	<i>Journal of Molecular Biology</i>
36	<i>Media Culture &amp; Society</i>
37	<i>European Journal of Psychological Assessment</i>
38	<i>British Journal of Guidance &amp; Counselling</i>
39	<i>Communication Research</i>

This short catalog of serendipitous connections is by no means unintended. It permits me to segue to Merton's fascination with that topic. Like so many of Merton's disciples, I await the forthcoming English language edition of his *Travels in Serendipity*.<sup>7</sup> On Veteran's Day, 2002, Bob presented me a copy of the Italian edition<sup>8</sup> in which he inscribed: "These Travels ... finally find their way into print as a sort of time capsule some 45 years after they were set down in....English." It was poignant to have been at Bob's bedside, not long before he died, when he learned that Princeton University Press would indeed publish the English edition.

A recent paper on "Serendipity and Information Seeking,"<sup>9</sup> draws on a number of interesting sources on that subject. The authors state simply that "In the social sciences, serendipity appears in a similar 'connection building' role. Merton describes this process within sociological research." The reference is to the 1968 edition of Merton's *Social Theory and Social Structure* (STSS), where he discusses the concept of "Serendipity Patterns" in some detail. Unfortunately, like most references to STSS, the citation is pageless, that is, it fails to cite chapter V or pages 157-162 explicitly.

Merton defines serendipity succinctly as "the discovery, by chance or sagacity, the valid results which were not sought for (4)." In that footnote number 4 Merton cites his earlier paper on "Sociological Theory" in *American Journal of Sociology*," 50 (1945) 469. In the next footnote, he refers to the incipient and still awaited monograph by himself and Elinor Barber concerning the cultural diffusion of the word serendipity. The history of the dormancy of this work for about 45 years is explained in Merton's preface to *Travels*. This is indeed an unusual reverse time lapse. Normally, the opposite situation would have occurred. The Italian-language edition would have appeared years after the English language edition.

The scholarly output of a Bob Merton in a sense defies any reasonable characterization by citation analysis. This applies not only to the papers that cited Merton but also to the diversity of the works he has cited.

The example of pageless documentation cited earlier highlights one of the deficiencies of citation analysis. These ambiguities can only be resolved by citation analysis in context. That is the best way to differentiate this particular reference to STSS, from the thousands of other citations of that book. While the article title reveals the serendipity connection, it is not apparent to the reader why the book cited has any bearing on the subject. I do not understand the lack of precision in so many book references. This has been called pageless documentation by Roy P. Fairfield.<sup>10</sup> In sharp contrast, Bob was absolutely meticulous about his references.

Those of us who have worked in the field of scientometrics and its antecedent bibliometrics – almost universally recognize the debt we owe to Robert K. Merton. That perception was concretized and immortalized when he was awarded the Derek J. deSolla Price Medal in 1995. Yet, ironically with the exception of his letter acknowledging that reward,<sup>11</sup> Merton never published in *Scientometrics* itself.

That can be easily understood since he had not himself published much of a purely bibliometric nature. And it is understood that a scholar of his stature would have gravitated to or been invited to write not only for the leading journals of sociology and the history of science, but also for large circulation general science journals like *Science*.

The roots of the term bibliometrics can be traced to Paul Otlet (1934) who first used the term bibliometric.<sup>12,13</sup> Then in 1969, Pritchard coined the term bibliometrics.<sup>14</sup> The technique of statistical bibliography itself had even earlier roots, and can be traced to Cole and Eames (1917),<sup>15</sup> Hulme (1923),<sup>16</sup> Lotka (1926)<sup>17</sup> and Gross and Gross (1927).<sup>18</sup> This history is reviewed in detail by Arnold Thackray.<sup>19</sup> While the roots go further back, J. D. Bernal's 1939 *Social Function of Science*<sup>20</sup> gave a significant impetus to the "science of science."<sup>21,22</sup> Bernal's key role in the social studies of science is reflected in the J.D. Bernal Award of the Society for the Social Studies of Science (4S). Derek Price was the first recipient. Merton served as the first president of 4S and received the second award in 1982.

4S was established in 1975, a decade after the *Science Citation Index* was launched. These and other events combined with the launch of the *Social Sciences Citation Index* in 1975 accelerated the conditions for the gelling of the field of scientometrics and led in 1978 to the founding of *Scientometrics* as the quasi-official journal of the field.

The term scientometrics had been coined by V.V. Nalimov in the late sixties.<sup>23</sup> A conference on scientometrics and bibliometrics was held in January of 1976.<sup>24</sup> Derek Price used the term that same year<sup>25</sup> and was undoubtedly familiar with Nalimov's work which had been quickly translated into English. Scientometrics soon displaced the Bernalian term "science of science."

However, it is Price's primordial works *Science Since Babylon*<sup>26</sup> (SSB) and *Little Science, Big Science*<sup>27</sup> (LSBS) which account for the metaphoric description of Derek as the "father of scientometrics." The latter was used, not in connection with the term itself, but rather with respect to the quantitative studies of science that he pioneered in SSB and LSBS in the early sixties. This is the same period during which the sociology of science emerges in the USA, as described by Cole and Zuckerman<sup>28</sup> as well as in Merton's small paperback *The Sociology of Science – An Episodic Memoir*<sup>29</sup>

The term "scientometrics" does not appear in the first edition of LSBS but rather in the second edition.<sup>30</sup> The latter includes a reprint of Derek's two-part 1976 "scientometrics" paper cited above.<sup>25</sup> And we did not mention this etymology in the foreword to the second edition where Merton and I describe Derek as the father of scientometrics.<sup>31</sup>

Twenty three years ago, my colleagues and I at ISI did a rather comprehensive citation analysis of Merton's influence.<sup>32</sup> That type of study will require periodic updates. They are made much easier today by the availability of the *ISI Web of Science*. This will improve further when there is greater access to full texts on the web. Future

citation analyses in context will be possible using the techniques pioneered by Steve Lawrence in *Research Index*.<sup>33</sup> What has been done for computer science can be extended to include legacy electronic files of the social sciences literature. A step in that direction has been taken for economics.<sup>34</sup>

The problems in accomplishing this goal will not be trivial but it is difficult for me to imagine doing a proper citation in context analysis of Merton's work without such a tool. This type of superhuman labor was routinely expended by scholars in the past. Doctoral dissertations required years of rummaging through library stacks to find the contexts in which some philosopher or scholar had been discussed. I am reminded of Columbia University Professor Allen T. Hazen's remarks to me when he read my original manuscript on the putative SCI in 1953 while I was a library science student at Columbia University. He suggested that citation indexes would vitiate many a doctoral dissertation as they were then created. Well, the *Social Science Citation Index* (SSCI) and *Arts and Humanities Citation Index* (A&HCI) may have made it easier to do the literature searching, but there still remains the task of retrieving the original citing works and locating the contexts of the citations.<sup>35</sup>

The SSCI and A&HCI are often criticized because they do not include monographs as source material. In spite of this deficiency, studies of highly-cited books have been published.<sup>36</sup> But it is remarkable how few scholars are aware of this capability. SSCI does in fact "cover" cited books. Similar confusion is expressed about multiple authorship in the SSCI. For over two decades, citation index entries can be found under each co-author's name.

Nevertheless, I would agree that the lacunae in SSCI source book coverage is important. Solving the problem, even if the full text of all significant books became available in electronic form, is not trivial. Once digitizing legacy files has been accomplished, it will be easier to go back to citation index the literature of past centuries. In contrast to journals, books played a prominent if not dominant role in the early history of social and natural science. What a feast this will provide future scholars.

Merton's *Science, Technology & Society in Seventeenth-Century England*<sup>37</sup> exemplifies his incredible mastery of the monographic literature. He would heartily applaud source coverage of monographs in the SSCI. Incidentally, as Harriet Zuckerman reminded me recently, *Science, Technology & Society in Seventeenth-Century England* included an early foray into quantitative studies of science, including his analysis of the mining and coal industry, military technology and armament, shipping, ship building, and transportation. But more significant in his groundbreaking analysis of the religious origins of 17th century scientists in the *Dictionary of National Biography*.

In my recent contribution in SSS,<sup>1</sup> I pledged to create HistCite files for most of Merton's work. This is an ongoing work in progress. A recent addition is the HistCite collection of 400 papers that have cited Merton's "Student Physician,"<sup>38</sup> which illustrates Merton's influence on the sociology of medicine. The book is still discussed

in courses on medical sociology. It is fascinating to note from the HistCite analysis the wide variety of journals in which that work is cited. This multi-disciplinary impact is also observed in the HistCite file for his 1938 paper on “anomie”<sup>39</sup> – indeed for all of his work.

An interesting feature of these HistCite databases is the ability to identify the authors and works with whom Merton is co-cited. And using the citation matrices that accompany the HistCite files, one can create co-citation maps to help students visualize his influence. This co-citation technique is well illustrated by the work of Howard White and Kate McCain of Drexel University.<sup>40</sup> Vladimir Batagelj of Yugoslavia has used HistCite matrices to create “critical path” maps as well.<sup>41</sup>

However, co-citation and critical path maps are quite distinct from historiographs, which are routinely produced in HistCite. The latter provide a chronological perspective which can not be readily seen in a co-citation map.

The Mertonian influence on information studies was also discussed in my Lazerow lecture at the University of Pittsburgh.<sup>42</sup> Using the initial output of a search on the *Web of Science* combined with manual input of cited references outside the immediate collection, the map which resulted from a combined manual and electronic input showed the connection between bibliographic coupling/co-citation connection and the Zuckerman-Merton paper on “refereeing.”<sup>43</sup> The impact outside information science is even greater.

It was Merton himself who used this paper and other examples as self-exemplifying the Matthew Effect since scholars sometimes inadvertently cite the paper as Merton/Zuckerman. And this can be verified by examining the SSCI itself. One easily finds entries in the Citation Index to the paper under Merton. These errors may now be partially “obliterated,” to use a Mertonian phrase, as ISI has been able to correct many of these errors in its electronic files. It is for these and other reasons that Merton wrote to Tibor Braun on April 14, 1995 that the Price Award should have been shared with his former student and colleague, Harriet Zuckerman. The text follows:

“Dear Professor Braun,

I am moved, and honored, by word that I have been chosen to share the 1995 Derek de Solla Price Award with Professor Anthony F. J. van Raan. All the more, since Derek was a close and much admired friend over many years and since Gene Garfield and I had the privilege of introducing the new, enlarged, edition of Derek’s magnum opus, *Little Science Big, Science,...and Beyond*.

Still, I note that the name of Harriet Zuckerman, my collaborator for some 30 years, has somehow become dissociated from mine, unlike the pairing of the Coles in this year’s (and earlier) ballots and unlike the pairing of Harriet and myself, say, in the 1989 ballot. Knowing the great extent of that collaboration and noting the frequency

with which she has appeared among the topmost nominees for the Derek Price Award, I earnestly request that this be acknowledged by having the one share of the 1995 Award assigned to us as a pair. Derek would not have wanted to have his Prize put asunder what God and Academe have joined together.

We hope to be at the 5th International conference on Informetrics and Scientometrics to be held in Chicago this June. Once again, my appreciation of this great honor.

Sincerely,

Robert K. Merton”

Bob’s feelings on this matter were expressed even more precisely in the letter he sent to me six months earlier (September 25, 1994):

“Gene,

I have enjoyed the irony that the Matthew effect – named, of course, after the passage in the Gospel that holds: “to everyone that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath” – is evidently at work in the frequent mis-citation of our joint papers as being by “Merton and Zuckerman” even though Harriet Zuckerman is explicitly designated as the first, ‘senior’ author. (See Zuckerman H. & Merton R.K., “Patterns of evaluation in science: institutionalization, structure and functions of the referee system,” *Minerva* 9, 66-100, 1971, and Zuckerman H. & Merton R.K., “Age, aging, and age structure in science,” in “Aging and Society,” vol. 3, *A Theory of Age Stratification*, Matilda White Riley, Marilyn Johnson, Anne Foner, editors, 1972, Russell Sage Foundation, N.Y.)

It is ironic, of course, inasmuch as I am here the dubious “beneficiary” of the Matthew effect precisely in accord with that effect which holds that such patterns of biased peer recognition of authors of collaborative papers are often “skewed in favor of the [more] established scientist.” [Merton R.K. “The Matthew effect in science: the reward and communication systems of science,” *Science* 159, 56-63, 1968]. Furthermore, as I’ve noted, the Matthew effect is here self-exemplifying. This, in turn, is in accord with my further claim that the discipline of the sociology of science must exhibit a strongly self-exemplifying character in its own development and that valid ideas in the sociology of science must apply to the “cognitive and social behavior of sociologists of science themselves” (Merton, R.K., “Multiple discoveries as strategic research site,” in Merton, R.K., *The Sociology of Science*, p. 382, 1973, Chicago: University of Chicago Press).”



As you see, this is a rare case in which the workings of the Matthew effect and the self-exemplifying character of the sociology of science are *both* nicely exemplified!

Most of what I have written about Bob Merton is available at my personal website,<sup>44</sup> which has been augmented by creating a directory which includes not only Merton's Curriculum Vitae but also an up-to-date bibliography of his publications<sup>45</sup> and several of his articles in full text.

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