

Medical Criminology Notes #4*:

Measuring the Impact of Isaac Ray: A Citation Analysis**

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Publication of his *Treatise on the Medical Jurisprudence of Insanity* in 1838 clearly established Isaac Ray as the forefather of forensic psychiatry in the United States. In anticipation of the Isaac Ray Symposium Issue of the *Bulletin*, it seemed of some interest to inquire as to the extent of Ray's influence upon scholarship today, some 140 years later.

Averse to appeals to authority as a means of proof, I sought a quantitative method of measuring Ray's impact. A sample survey of the world's scholars or a content analysis of scholarly publications would provide an answer, but at too great a cost. I opted for a technique that can serve as an efficient proxy for content analysis. This technique is citation analysis, a powerful method developed in the past quarter century for scientific use. Citation analysis is already being used to forecast Nobel laureates, and there is a longstanding controversy over its use for selecting candidates for scientific awards, employment, research grants, and promotion. Citation analysis deserves explication for readers unfamiliar with its use.

Citation Analysis

A citation index is a structured list of all the citations in a given collection of documents, usually arranged so that each cited document is followed by a list of the citing documents.¹ Citation indexes for the sciences were originated by Eugene Garfield, whose corporation, the Institute for Scientific Information, publishes *Science Citation Index (SCI)* and *Social Science Citation Index (SSCI)*, the two indexes used for the present study.

SCI and *SSCI* both include a Citation Index and a Source Index. The Citation Index is an alphabetical list of authors cited during the time period covered by the volume followed by a tabulation of the publications cited, an

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abbreviated reference to each citing author, and bibliographic data on the citing publication. The Source Index provides further information on the citing articles. The data base for *SCI* consists of over 2600 journals and for *SSCI* of over 1500 journals. Journals are selected for inclusion by advisory boards of experts from each of the fields represented and by large-scale analyses of the frequency with which each journal's articles are cited. Although not all-encompassing, *SCI* and *SSCI* are believed to include a high proportion of the significant literature in the sciences and social sciences, respectively.

Citation indexes have many applications, and one that was recognized early is the counting of citations to measure the impact of an individual author. In his 1955 landmark paper proposing a citation index to science comparable to *Shepard's Citations*, Garfield noted that such an index "would clearly be particularly useful in historical research, when one is trying to evaluate the significance of a particular work and its impact on the literature and thinking of the period. Such an 'impact factor' may be much more indicative than an absolute count of the number of a scientist's publications . . ."²

Garfield has repeatedly warned against the "promiscuous and careless use of quantitative citation data" for evaluations of individual authors, stressing that impact is not the same as importance of significance³ and that citation counts must be combined with qualitative judgments if they are to be useful in evaluating the work of individuals.^{4,5}

Citation counting is only one form of citation analysis.⁶ Being a simple form, it is easily criticized. It is noteworthy that despite the repeated cautionary notes about reliance on simple citation counts of individual authors, Garfield's organization each week honors an individual author through the "Citation Classics" column of the various editions of *Current Contents* and produces frequent lists of the most heavily cited authors in various branches of science and social science.

I am unaware of any previous studies of the citations received by psychiatric authors; although psychiatrists are represented in the lists of highly cited articles in physiologic psychology and animal behavior⁷ and in human psychology and behavior.⁸ Also, I am unaware of any previous studies comparing the frequencies with which an identifiable group of nineteenth century colleagues have been cited in the 1960s and 1970s.

Citations to Issac Ray

Each citation to "Ray I" or "Ray IA" was examined in the volumes of *SCI* covering the period from January 1961 through March 1978 and in the volumes of *SSCI* from January 1972 through April 1978. This constitutes a complete search of all published volumes of these indexes. In *SCI* forty-two citing sources were examined, and in *SSCI* twenty-seven citing sources. The citing sources in *SSCI* included nine that were also listed in *SCI*, leaving a total of sixty unique citing sources. Using the Source Indexes of *SCI* and *SSCI* and examining the citing documents in ambiguous cases, twenty-one of these unique citing sources were determined to represent citations to authors named "I. Ray" other than the nineteenth century author under consideration. Thus, thirty-nine unique sources citing Isaac Ray were

identified.

Table 1 is a chronologically ordered, numbered list of all of the writings of Isaac Ray that were cited by the thirty-nine citing sources. As shown in Table 1, eighteen writings by Isaac Ray spanning the years from 1838 to 1880 were cited by the thirty-nine citing sources. The eighteen writings include books, journal articles, manuscript letters, a lecture, and an annual report of the Butler Hospital. From Table 1 alone it is not possible to measure the relative impact of the cited writings, though one might well expect books and journal articles to surpass in influence Ray's less readily available works.

Table 2 identifies the thirty-nine citing sources, in chronological order, and indicates which of Ray's writings were cited by each. Of the thirty-nine citing sources, thirty-two cited only one of Ray's writings, three cited two writings, two cited three writings, one cited four writings, and one cited seven writings. The thirty-nine citing sources include a total of fifty-five citations to Isaac Ray.*

It is noteworthy that three of the four articles citing more than two of Ray's works were written by Jacques Quen, who authored five of the thirty-nine citing papers and contributed seventeen of the fifty-five citations (31%). Dr. Quen, of the Cornell Medical College, is well known to readers of the *Bulletin* as the leading authority on Isaac Ray, and this reputation is borne out by the present study.

Of the fifty-five citations to Ray, twenty are to his *Treatise on the Medical Jurisprudence of Insanity*, ten to *Mental Hygiene*, and five to *Contributions to Mental Pathology*. Twelve of Ray's cited writings received only one citation each, and eight of these solitary citations were contributed by Quen.

Ray's Relative Impact

The above data on citation frequency are difficult to interpret without some standard against which Ray's impact can be measured. Most published data on citation frequency deal with physical scientists and twentieth century authors. To properly measure Ray's impact, an appropriate comparison group must be identified. For this purpose, I have chosen to compare Ray's impact to that of the other twelve physicians who in 1844, along with Ray, founded the American Association of Medical Superintendents, progenitor of the American Psychiatric Association.

Table 3 gives the names of "the original 13," in order to total citation impact. The data are approximate for individuals other than Ray, for the labor involved in verifying these sources with the degree of accuracy attempted for Ray would have been excessive for the present application of

*The reader who has followed this presentation to this point will have noted that there are many familiar citations to Isaac Ray that have not shown up in this analysis. For example, reference is frequently made to Ray in the *Bulletin*, but none of these citing sources was identified in the analysis. This is because the *Bulletin* is not yet covered by either of the citation indexes used, despite the fact that *Social Science Citation Index* purports to cover periodical literature on psychiatry and on law. Most of the specialized publications in the forensic sciences, legal medicine, and law and behavior are not covered by these indexes, presumably because they are not cited with sufficient frequency in the journals that are included. To remedy this we must cite our specialized journals more frequently when we contribute to more general publications.

the data. Despite some lack of precision, the result is clear: among this group of contemporary leaders, Isaac Ray has had the greatest impact on scholarship today, with a total citation frequency 1.7 times that of Amariah Brigham, his nearest citation competitor.

The "original 13" received between zero and fifty-five citations each, with a mean of approximately twelve. Over one-third of all of the citations to these thirteen leading figures of their day are to Isaac Ray. The disproportionately high citation of Ray is clearly higher than would be expected by chance alone. I therefore conclude that Isaac Ray has had a significantly greater impact on modern scholarship than any of his twelve peers.

References

1. Weinstock M: Citation indexes. In Encyclopedia of Library and Information Science, Vol. 5 New York, Marcel Dekker, 1971, pp. 16-40
An overview of the history, structure, and uses of citation indexes.
2. Garfield E: Citation indexes for science. Science 122:108-111, 15 Jul 1955
The original proposal by the originator of Science Citation Index and Social Science Citation Index.
3. Garfield E: Citation indexes in sociological and historical research, Am. Documentation 14:289-291. (Oct. 1963)
Warns against abuses of citation data and proposes a computer technique for constructing historical network diagrams.
4. Garfield E: Citation measures used as an objective estimate of creativity. In Garfield E: Essays of an Information Scientist, Vol. 1, 1962-1973. Philadelphia, ISI Press, 1977, pp. 120-121
Reports the acceptance of citation indexing as a valid measure in evaluating and comparing scientific merit.
5. Garfield E: Citation frequency as a measure of research activity and performance. In Garfield E: Essays of an Information Scientist Vol. 1, 1962-1973, Philadelphia, ISI Press, 1977, pp. 406-408
Mentions some values and limitations of citation counting.
6. Martyn J: Citation analysis. J Documentation 31:290-297, Dec 1975
Brief and useful overview of the forms and uses of citation analysis.
7. Garfield E: Highly cited articles: 18. Physiologic psychology and animal behavior. In Garfield E: Essays of an Information Scientist, Vol. 2, 1974-1976. Philadelphia, ISI Press, 1977, pp. 257-261
Presents a list of 62 articles in these fields that are cited at least 75 times during the period 1961-1973.
8. Garfield E: Highly cited articles: 19. Human psychology and behavior. In Garfield E: Essays of an Information Scientist, Vol. 2, 1974-1976. Philadelphia, ISI Press, 1977, pp. 262-268
Presents a list of 99 articles from these fields that were cited at least 75 times during the period 1961-1973.

Other Sources

9. Hayman M, Peskin R: Need of the research-oriented psychiatrist for information retrieval. Dis Nerv Syst 28:798-803, Dec 1967
Mentions the use of Science Citation Index to identify research that has followed the publication of a "key article" acknowledging all previous work of significance on a particular topic.
10. Broadus RN: The literature of the social sciences: A survey of citation studies. Int Soc Sci J 23:236-243, 1971
Reviews studies of citation patterns in the social sciences, typically consisting of tabulations of the percentages of citations by subject area, language, publication form, and age.
11. Cole JR, Cole S: The Ortega hypothesis. Science 178:368-374, 27 Oct 1972
An important study indicating that only a few scientists contribute to scientific progress, at least in physics.
12. Garfield E: Essays of an Information Scientist, 2 vols. Philadelphia, ISI Press, 1977
A valuable collection of reprinted papers that document the growth of Garfield's thinking, of citation indexing and analysis and of the Institute for Scientific Information.

TABLE 1
WRITINGS OF ISAAC RAY CITED IN
*SCIENCE CITATION INDEX AND SOCIAL SCIENCE CITATION INDEX**

(1)	1838	A Treatise on the Medical Jurisprudence of Insanity. Boston: Little and Brown (also 1839, 1853, and 1860 editions and the 1962 Reprint Edition edited by W Overholser, Cambridge, Mass.: Belknap Press of Harvard University Press)
(2)	1846	Observations on the principle hospitals for the insane in Great Britain, France, and Germany. <i>Am J Insanity</i> 2:289-390
(3)	1849	The statistics of insane hospitals. <i>Am J Insanity</i> 6:23-52
(4)	1851	Education in its relation to the physical health of the brain. A lecture delivered before the Rhode Island Institute of Instruction, 18 Oct 1850. Boston: Ticknor, Reed, & Fields
(5)	1852	On the best methods of saving our hospitals for the insane from the odium and scandal to which such institutions are liable, and maintaining their place in the popular estimation; including the consideration of the question how far is the community to be allowed access to such hospitals? Paper presented at a meeting of the Association of Medical Superintendents of American Institutions for the Insane, New York, 18 May 1852. Published in <i>Am J Insanity</i> 9:36-65, 1852
(6)	1854	Manuscript letter to Parker Cleaveland, 23 Mar 1854 (Alumni Archives, Alumni Office, Bowdoin College, Brunswick, Maine)
(7)	1855	Insanity of King George III. <i>Am J Insanity</i> 12:1 (also reprinted in <i>J Psychol Med Ment Path</i> 10:95, 1857; translated by H Laehr, <i>Allg Z Psychiat</i> 18:407, 1861; republished with additions in <i>Contributions to Mental Pathology</i> , Boston: Little and Brown, 1873)
(8)	1855	Manuscript letter to Edward Jarvis, 3 Nov 1855 (Edward Jarvis Collection, The Francis A. Countway Library of Medicine, Harvard University, Boston, Mass.)
(9)	1859	Butler Hospital Report for the Year 1859, pp. 19 ff
(10)	1861	An examination of the objections to the doctrine of moral insanity. <i>Am J Insanity</i> 18:112
(11)	1863	Mental Hygiene. Boston: Ticknor & Fields (also 1968 facsimile edition, New York: Hafner Publishing Company)
(12)	1866	The insanity of women produced by desertion or seduction. <i>Am J Insanity</i> 23:267
(13)	1868	"A Modern Lettre de Cachet" reviewed. <i>Atlantic Monthly</i> 22:227-243
(14)	1869	Confinement of the insane. <i>Am Law Rev</i> 13:193-217
(15)	1873	Contributions to Mental Pathology. Boston: Little and Brown (also 1973 Reprint Edition, New York: Delmar)
(16)	1878	The cost of constructing hospitals for the insane. <i>J Nerv Ment Dis</i> 5:47-56
(17)	1879	Recoveries from mental disease. <i>Trans Col Physicians Phila</i> , 3rd series, 4:217-230 (reprinted in <i>Alienist and Neurologist</i> 1:131-142, 1880)
(18)	1880	Manuscript letter to Dorothea L. Dix, 29 Nov 1880 (Dorothea L. Dix Collection, Houghton Library, Harvard University, Cambridge, Mass.)

TABLE 2
SOURCES CITING ISAAC RAY, KEYED TO RAY'S CITED WRITINGS**

Citing Source	Cited Writings by Ray (keyed to Table 1***)
Hare EH: Masturbatory insanity: The history of an idea. <i>J Ment Sci</i> 108:1, 1962	15
Brady JP: Publication trends in American psychiatry: 1844-1960. <i>Am J Psychiatry</i> 118:1069, 1962	1
Guttmacher MS: What can the psychiatrist contribute to the issue of criminal responsibility? <i>J Nerv Ment Dis</i> 136:103, 1963	1
Anonymous: A medicolegal classic. <i>JAMA</i> 184:306, 1963	1

*Derived from volumes of *Science Citation Index* covering the period from January 1961 through March 1978 and volumes of *Social Science Citation Index* covering the period from January 1972 through April 1978. Inconsistencies of format in this table reflect inconsistencies in the bibliographies of the citing publications (see Table 2).

**Derived from the same sources as the information in Table 1. Note that this table may contain errors of punctuation and other minor errors due to the author's having been unable to verify his efforts to decode "Source Index" abbreviations in all instances.

***The numbers in the second column refer to the numbers assigned to Ray's cited writings in Table 1.

TABLE 2 (Continued)

Citing Source	Cited Writings by Ray (keyed to Table 1***)
Usdin GL: Review of "A Treatise on the Medical Jurisprudence of Insanity" by I Ray. <i>Am J Psychiatry</i> 120:1033, 1964	1
Katz J, Goldstein J: Abolish the "insanity defense" – Why not? <i>J Nerv Ment Dis</i> 138:57, 1964	1
Schefflen NA: Concepts of mental illness and law. <i>Penn Psychiatric Q</i> 5:25, 1965	1
Weimerskirch PJ: Benjamin Rush and John Minson Galt, II: Pioneers in bibliotherapy in America. <i>Bull Med Lib Assoc</i> 53:510, 1965	2, 9, 11
Macalpine I, Hunter R: The insanity of King George III: A classic case of porphyria. <i>Brit Med J</i> 1:65, 1966	7
Tourney G: A history of therapeutic fashions in psychiatry 1800-1966. <i>Am J Psychiatry</i> 124:784, 1967	3
Cardno JA: Idocy imbecility: An early American contrast. <i>Psychol Rec</i> 18:241, 1968	1
Macalpine I, Hunter R: George the Third's illness and its impact on psychiatry. <i>Proc Royal Soc Med</i> 61:1017, 1968	7
Tourney G: History of biological psychiatry in America. <i>Am J Psychiatry</i> 126:29, 1969	1
Gorwitz K: Survey of state-level programs in mental health statistics. <i>Publ Health Rep</i> 84:803, 1969	3
Quen JM: James Hadfield and the medical jurisprudence of insanity. <i>NY State J Med</i> 69:1221, 1969	1
Heston LL: The genetics of schizophrenia and schizoid disease. <i>Science</i> 167:249, 1970	11
Meldman MJ: New medical model for psychiatric diagnosis. <i>Compr Psychiatry</i> 12:82, 1971	15
Gray SH: The insanity defense: Historical development and contemporary relevance. <i>Am Crim Law Rev</i> 10:559, 1972	1
Chambers DL: Alternatives to civil commitment of the mentally ill: Practical guides and constitutional imperatives. <i>Mich Law Rev</i> 70:1107, 1972	11
Kellett JM: Evolutionary theory for dichotomy of functional psychoses. <i>Lancet</i> 1:860, 1973	11
Brody EB: The Journal of Nervous and Mental Disease: The first 100 years: I. 1874-1881, setting the course, the editorship of JS Jewell. <i>J Nerv Ment Dis</i> 158:6, 1974	16
Wales HW: The rise, fall and resurrection of the medical model. <i>Georgetown Law Rev</i> 63:87, 1974	1
Quen JM: Review of "Discovery of the Asylum: Social Order and Disorder in the New Republic" by DJ Rothman. <i>J Psychiatry Law</i> 2:105, 1974	1, 15
Gorwitz K: Census enumeration of the mentally ill and mentally retarded in the nineteenth century. <i>Health Serv Rep</i> 89:180, 1974	3
Maxon JR: <i>Kaimowitz v. Department of Mental Health: The right to be free from experimental psychosurgery</i> . <i>Boston Univ Law Rev</i> 54:301, 1974	11
Quen JM: Learning from history. <i>Psychiatric Ann</i> 5:15, 1975	1, 14, 15
Fullinwider SP: William James's "spiritual crisis." <i>Historian</i> 38:39, 1975	11
Barker-Benfield B: Sexual surgery in late 19th century America. <i>Int J Health Serv</i> 5:279, 1975	11, 12
Peck CL: Current legislative issues concerning the right to refuse versus the right to choose hospitalization and treatment. <i>Psychiatry</i> 38:303, 1975	1
Vertinsky PA: Effect of changing attitudes toward sexual morality upon promotion of physical education for women in 19th century America. <i>Can J Hist Sport Phys Educ</i> 7:26, 1976	11
Kauffman JM: Nineteenth century views of children's behavior disorders: Historical contributions and continuing issues. <i>J Spec Educ</i> 10:335-349, 1976	2, 5

***The numbers in the second column refer to the numbers assigned to Ray's cited writings in Table 1.

TABLE 2 (Continued)

Citing Source	Cited Writing by Ray (keyed to Table 1 ^{***})
Pezzuli MF: Criminal law – criminal responsibility – A pragmatic approach to the fourth circuit. <i>W Va Law Rev</i> 78:478, 1976	1
Anonymous: Ray's enduring legal treatise. <i>Hosp Comm Psychiatry</i> 27:480, 1976	1
Braceland FJ: Bicentennial address: Benjamin Rush and those who came after him. <i>Am J Psychiatry</i> 133:1251, 1976	1
Quen JM: Asylum psychiatry, neurology, social work, and mental hygiene: An exploratory study in interprofessional history. <i>J Hist Behav Sci</i> 13:3, 1977	10, 13, 15, 17
Quen JM: Isaac Ray and mental hygiene in America. <i>Ann NY Acad Sci</i> 291:83, 1977	1, 2, 4, 6, 8, 11, 18
Herr S, Cottle TJ: Barred from school – 2 million children. <i>Harvard Civil Rights-Civil Liberties Law Rev</i> 12:491, 1977	1
Wolfgang ME: Real and perceived changes of crime and punishment. <i>Daedalus</i> 107:143, 1978	1
Gadlin H: Scars and emblems: Paradoxes of American family life. <i>J Social Hist</i> 11:305, 1978	11

TABLE 3
CITATION FREQUENCIES FOR THE 13 FOUNDERS OF
THE AMERICAN ASSOCIATION OF HOSPITAL SUPERINTENDENTS*

Founder's Name	No. of Works Cited	No. of Unique Citing Sources	Total No. of Citations
Isaac Ray	18	39	55
Amariah A. Brigham	16	25	34
Thomas S. Kirkbride	8	18	21
Pliny Earle	9	17	18
John M. Galt	6	6	13
Samuel B. Woodward	8	8	10
Luther V. Bell	2	3	4
John S. Butler	1	2	2
Francis T. Stribling	2	2	2
William M. Awl	0	0	0
Nehemiah Cutter	0	0	0
Charles C. Stedman	0	0	0
Samuel S. White	0	0	0

*Data derived from the same sources as the information in Tables 1 and 2. Citations and sources were not verified for founders other than Ray, so the resulting data must be considered approximate.

***The numbers in the second column refer to the numbers assigned to Ray's cited writings in Table 1.