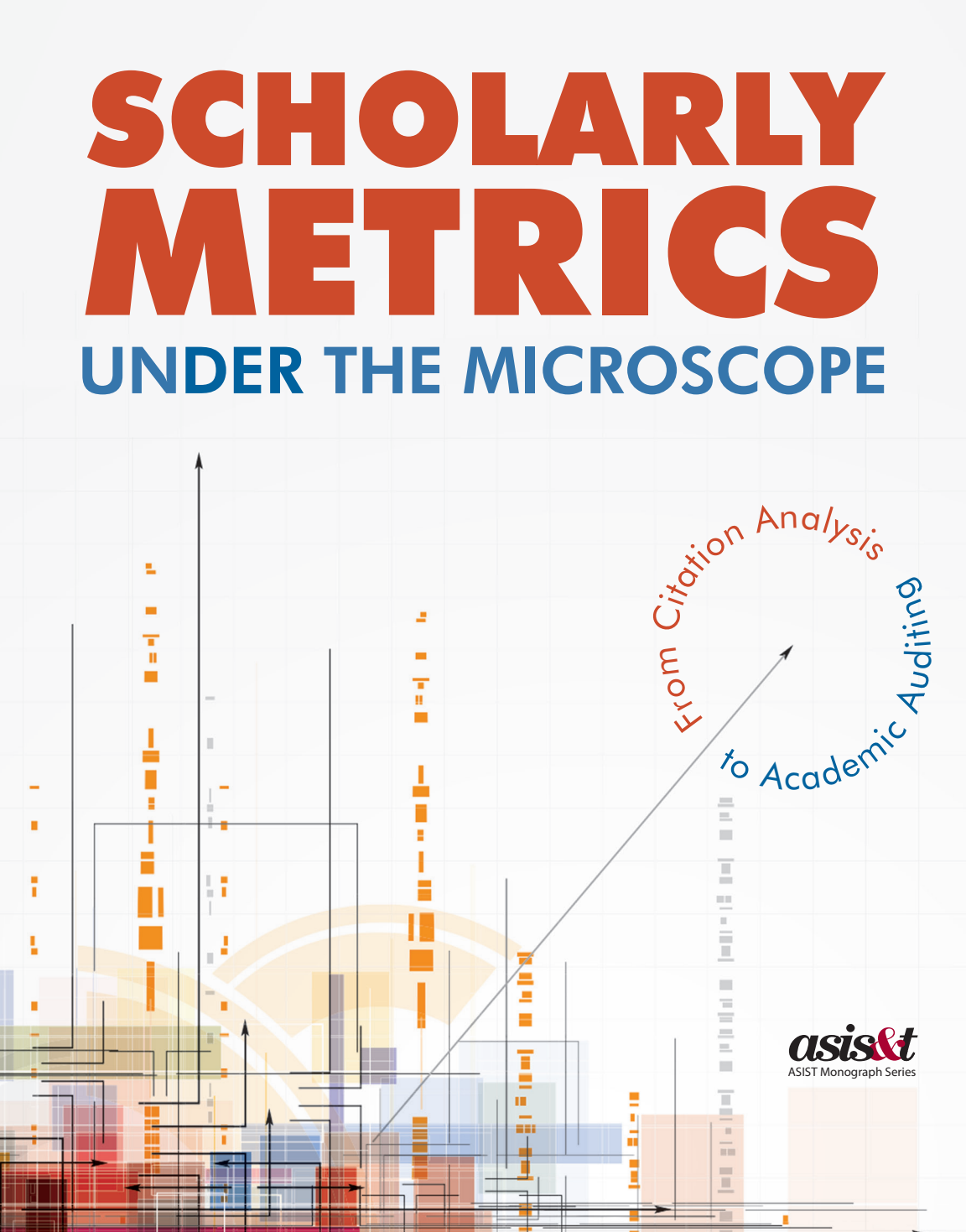


SCHOLARLY METRICS

UNDER THE MICROSCOPE



From Citation Analysis
to Academic Auditing

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ASIST Monograph Series

**Edited by Blaise Cronin
and Cassidy R. Sugimoto**

Praise for *Scholarly Metrics Under the Microscope*

Cronin and Sugimoto present an excellent overview of scholarly metrics in this wide-ranging collection of essays from many disciplinary and critical perspectives—both recent as well as those that have shaped the field from the start. An indispensable volume for anyone who is concerned with measuring the impact of knowledge in today's digital world, including scholars, publishers, information scientists, and research policymakers.

—Ralph Schroeder, Professor, Oxford Internet Institute, University of Oxford

Sixty years of bibliometric research has produced an extensive body of literature, reduced by the editors of this volume to a manageable and readable number of key papers. They have included several important pieces of bibliometric research that some experienced bibliometricians may not be aware of.

—Lutz Bornmann, Division for Science and Innovation Studies, Max Planck Society, Munich

*Cronin and Sugimoto have put together a most appealing compilation of classic papers and current thinking on scholarly publication analyses. Their perspective boosts usability greatly. *Scholarly Metrics Under the Microscope* will be highly valued by scientometric researchers and, especially, by those teaching courses that treat citation analyses.*

—Alan Porter, Professor Emeritus, Industrial and Systems Engineering, and Public Policy, and Co-Director, Technology Policy and Assessment Center, Georgia Tech

Anyone interested in the current uses (and abuses) of bibliometrics should have this on her bookshelf, and it should be required reading for those who seek to use bibliometrics to evaluate research funding.

—Julia Lane, American Institutes for Research

Over the last half-century or so, techniques have been developed to measure research impact by using aspects of the scholarly publication system itself; these “metrics” have now come into widespread use. Combining historical and current research articles with their own insightful and entertaining commentary, Cronin and Sugimoto bring the reader to a state-of-the-art understanding of this increasingly important, highly controversial field.

—Michael Kurtz, Harvard-Smithsonian Center for Astrophysics, Cambridge, MA

Cronin and Sugimoto put scholarly metrics under the microscope, exploring history, theory, concepts, methods, and policy in the use of citation metrics to evaluate scholarly communication. The carefully selected and organized readings, in combination with the editors' critical commentary, make this a valuable text for graduate courses in bibliometrics, scholarly communication, and higher education policy.

—Christine L. Borgman, Professor and Presidential Chair in Information Studies, University of California at Los Angeles

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Introduction: The Drunk, the Keys, and the Streetlamp

Blaise Cronin and Cassidy R. Sugimoto

We originally proposed *The Drunk, the Keys, and the Streetlamp* as the title of this book. Our publisher demurred, rightly perhaps. Our attempt at wit might have been mistaken for flippancy or as evidence of some kind of bias. The intention was simply to convey a sense of the ever more desperate quest for off-the-shelf, quantitative indicators of scholarly impact. Without wishing to resort to hyperbole, we are witnessing the development of an academic “audit culture” (Burrows 2012, 355) and the emergence of a “mandarinate of metrics” (Cronin 2014, 12). What began life as a tool for retrieving the literature of science, namely, the *Science Citation Index (SCI)*, has become, unwittingly, the basis of a system for calibrating scientific performance and shaping careers. How this situation has arisen, and what it portends, is the focus of this critical reader.

Philip Larkin opens his poem “Annus Mirabilis”¹ with this oft-quoted couplet: “Sexual intercourse began / In nineteen sixty-three.” So, as it happens, did citation indexing; that is to say, Eugene Garfield produced the first edition of the *SCI* that year. The *SCI* had a lengthy gestation period. Several years earlier, Garfield, who acknowledges the inspiration of *Shepard’s Citations* (an index to American case law commentaries), had outlined his thinking in a landmark paper, “**Citation Indexes for Science: A New Dimension in Documentation Through Association of Ideas**,” published originally in *Science* (Garfield, 1955), reprinted in the *International Journal of Epidemiology*, and reproduced first in this volume to set the stage. What he envisaged was “a bibliographic system for science literature” that would, inter alia, “eliminate the uncritical citation of fraudulent, incomplete, or obsolete data by making it possible for the conscientious scholar to

be aware of criticisms of earlier papers” (Garfield 1955, 108). The tool, which he termed “an association-of-ideas index” (108), would also “provide each scientist with an individual clipping service” by showing which other scientists “were making reference to his work” (109).

The concept of citation indexing is delightfully simple: “[E]very time an author makes a reference he is in effect indexing that work from his point of view” (110); the intervention of a human indexer is thus not required. At no point in his prospectus does Garfield make mention of using citation indexes to undertake performance evaluations of either individuals or institutions. He does, however, recognize the potential usefulness of such a system 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” (109). In fact, this is one of the first, if not the first, time that Garfield refers explicitly in print to an “impact factor” (109), a construct that has since acquired considerable baggage and become institutionalized in the form of the Journal Impact Factor (JIF). To his credit, Garfield has consistently, both in his presentations and publications (e.g., Garfield, 1996), cautioned against inappropriate use of impact factors, whether in ranking journals or individuals. Nonetheless, the genie is out of the bottle.

A citation index is generated from the bibliographic references attached to scholarly papers. Such an index to the whole of science allows us to see how the literature of science is woven together and how fields interrelate; it also allows us to determine whose work is most frequently cited, by whom, where, and when. It reveals, in the words of Joshua Lederberg, Nobel laureate and early champion of Garfield’s invention, the “parent-offspring relationships of publications” (Lederberg 1977, xi) or, to resort to a different metaphor, “a trace of conversations between texts” (Czarniawska 1998, 63). With hindsight, it is not hard to see why, once the *SCI* and its siblings (the *Social Sciences Citation Index* [*SSCI*] and the *Arts & Humanities Citation Index* [*AHCI*]) had established themselves and grown in size, usability, and functionality, first academics (notably sociologists and historians of science) and then administrators (in academe and government) used them to explore patterns of scholarly productivity, communication, and influence within and across disciplines.

There exists a sprawling literature on the subject of bibliometrics and its intellectual origins (e.g., Cronin and Atkins 2000; De Bellis 2009; Garfield 1979). Over the years, an array of tools and techniques has been developed to measure, with greater or lesser precision, scholarly

outputs and impacts. With the advent of commercial printed citation indexes in the 1960s and the subsequent development of online citation databases by the Institute for Scientific Information (ISI; founded by Garfield in Philadelphia and today part of the Thomson Reuters group), interest in bibliometrically informed research grew apace, as, indeed, did the methodological and conceptual sophistication of research undertaken in the area. The World Wide Web created new opportunities for quantitative analysis of scholarly communication behaviors and patterns, bringing us close to Robert Cameron's (1997) vision of a "universal citation database." Specifically, the availability of large-scale datasets, web logs, and usage statistics has opened up avenues of research that take us well beyond the data elements and models traditionally associated with statistical bibliography and citation analysis. In short, bibliometrics has come of age and now finds itself sharing a greatly expanded stage with a number of fashionable cousins: informetrics, scientometrics, cybermetrics, web(o)metrics, influmetrics, and digimetrics.

Interest in digital analytics is intense, as corporations, universities, foundations, research councils, and national governments seek to identify robust indicators of research effectiveness, whether at the macro, meso, or micro level. Just like any financial investor, research sponsors want to optimize their rates of return—pick winners, in the language of John Irvine and Ben Martin (1984). We now have a plenitude of corpora and data types (both scholarly and populist in nature, ranging from patents and astronomical data to hyperlinks and tweets) that can be monitored, mined, and manipulated to reveal evidence of disciplinary growth, socio-cognitive interaction, and intellectual impact that was heretofore largely invisible. We are no longer restricted to data about formal publications and conventional citations but can harvest widely to pull in novel indicators—alt(ernative) metrics to use the neologism—of scholarly dynamics and information consumption, and at an unprecedented level of granularity: Mentions, acknowledgments, endorsements, glosses, invocations, downloads, accesses, recommendations, and blog posts can all be fed into the hopper (Cronin 2013a, 2013b; Priem, Piwowar, and Hemminger 2012; Wouters and Costas 2012). A number of primary and secondary publishers are now using tools (e.g., Altmetric Explorer²) to generate article-level metrics—a multimetric approach to evaluation, if you will (Rousseau and Ye 2013)—that attempt to quantify the attention a scholar's work is receiving across a wide range of media

and contexts. But with the new measures come old concerns relating to validity, weighting procedures, and system transparency (Davis 2013).

Amid the excitement and experimentation, criticisms of metrics-based assessment of research and scholarship continue to be heard. For more than half a century, since the early days of the *SCI* in fact, many knowledgeable voices have raised concerns relating to the validity and reliability of bibliometric indicators, be they raw citation counts or more sophisticated yardsticks, such as the *h*-index, developed by Jorge Hirsch (2005) and refined by others since then (for a review, see Egghe 2010). Nevertheless, quantitative indicators are here to stay and their use has been institutionalized in the form of national research assessment exercises of one kind or another in countries such as Australia, Italy, Germany, and the U.K. For good or ill, contemporary scholars understand the rules of the game, now much more nuanced than the old “publish or perish” maxim implied, and how metrics—or more accurately the reliance of administrators and funders on quantifiable indicators of performance—can have a direct bearing on their career trajectories and the professional choices they make. Some, reluctantly or otherwise, will play the game, and a few will game the system shamelessly, while others, to the possible detriment of their careers, will seek out what they believe to be the moral high ground. As will become clear, many of the earliest caveats—Do publication and citation counts measure what they purport to measure? How reliable are the data upon which ratings and rankings are based?—find their echo today in the debate surrounding alternative indicators.

Recently, in the course of editing a multiauthor monograph *Beyond Bibliometrics* (Cronin and Sugimoto 2014), we came to realize that there exists a clear gap in the literature, one that deserves to be filled. There really isn’t a one-stop resource that catalogues the concerns—theoretical, conceptual, methodological, and ethical—associated with the fast-expanding set of scholarly metrics now in use, under consideration, or in development. It is certainly not our intention to throw the baby out with the bathwater, but we do feel that by assembling a representative cross-section of the literature critiquing evaluative bibliometrics we may be able to raise awareness of the approach’s limitations and also encourage greater procedural caution among relevant constituencies.

There is no shortage of material upon which to draw, given that our story begins more than half a century ago. In order to capture the

mood as well as the substance of the ongoing debate surrounding the use of indicators in academic evaluation, we have pulled together a diverse set of readings—scholarly papers, editorials, commentaries, blog posts, letters—that address different aspects of current trends and their antecedents. Inevitably, there is some thematic overlap across a few of the sections, but that, we feel, is forgivable since one of our objectives is to show that serious concerns relating to validity and reliability have been raised recurrently, from different quarters and from different perspectives, since the very earliest days of citation analysis, and not just in “argumentative” fashion (Lindgren 2011, 7). It is also worth pointing out that many of the contributions reprinted here have been written by scientists (e.g., physicists, chemists, biologists, botanists) or social scientists, not just by information scientists or bibliometricians. Others, given the same brief that we set ourselves, would in all likelihood come up with a somewhat different selection of papers, reflecting their knowledge of the field and their personal preferences (for more on this, see MacRoberts and MacRoberts 1989). For that reason we have written short scene-setting introductions for each of the six sections that provide additional context and multiple pathways into what is an overwhelmingly large and diffuse literature.

We conclude this introduction with a few words on the procedures we followed in compiling the volume. All of the reprinted articles were digitized, if not already in digital format. They were scanned using optical character recognition (OCR) software to transform them into textual documents. The text was then copied and inserted into a Word document. All documents were manually checked for accuracy in the transformation process. Any errors introduced during the process were corrected. However, the texts have been reproduced faithfully. We have not taken it upon ourselves to edit grammatical or stylistic errors—great though the temptation occasionally was. Abstracts have been retained, if present. Reference lists are captured as they appeared in the original article; that is, citation style and format (e.g., endnotes) have not been altered. (However, footnotes have been reformatted as endnotes in all cases.) The publication source for each item is given at the top of each reprinted article. All of the reprints are indicated with bold typeface in the introductory sections. When we quote from the reprinted documents, we refer to the original pagination. We have removed various data elements (e.g., fax numbers, emails) and have retained only the original institutional affiliations (where provided). Figures and tables have been captured

and resized when possible or else rendered faithfully, and have been inserted into the text at appropriate places. If the original figure was in color, this is indicated. Reprint permissions have been obtained for all 55 items, the majority through the Copyright Clearance Center. In some cases, individual publishers or individual authors were contacted. We are most grateful to Jylisa Doney for preparing the documents for reprinting, reference checking, and obtaining permissions.

Endnotes

1. Philip Larkin, "Annus Mirabilis," www.dailymotion.com/video/xjymf5_philip-larkin-annus-mirabilis_creation.
2. Almetric, www.altmetric.com/index.php.

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About the Editors

Blaise Cronin is Rudy Professor Emeritus of Information Science at Indiana University Bloomington, Honorary Professor at City University London, and Visiting Professor at Edinburgh Napier University. From 1985 to 1991, he was professor of Information Science at the University of Strathclyde in Glasgow. His books include *The Citation Process: Role and Significance of Citations in Scientific Communication* (1984, Taylor Graham), *The Scholar's Courtesy: The Role of Acknowledgement in the Primary Communication Process* (1995, Taylor Graham), *The Web of Knowledge: A Festschrift in Honor of Eugene Garfield* (edited with Helen Barsky Akins, 2000, Information Today, Inc.), *The Hand of Science: Academic Writing and Its Rewards* (2005, Scarecrow Press), and *Beyond Bibliometrics: Harnessing Multidimensional Indicators of Scholarly Impact* (edited with Cassidy Sugimoto, 2014, MIT Press). Cronin is editor-in-chief of the *Journal of the Association for Information Science and Technology (JASIST)*, and, for 10 years, he was editor of the *Annual Review of Information Science and Technology (ARIST)*. He holds an MA from Trinity College Dublin, and both a PhD and DSSc from the Queen's University of Belfast. He was awarded a DLitt (honoriscausa) by Queen Margaret University, Edinburgh in 1997. In 2006, he received the Award of Merit from the Association for Information Science and Technology (formerly the American Society for Information Science and Technology), the society's highest honor. In 2013, he received the Derek de Solla Price Award and medal in Vienna for "outstanding contributions to the fields of quantitative studies of science."

Cassidy R. Sugimoto is an assistant professor in the School of Informatics and Computing at Indiana University Bloomington. She researches within the domain of scholarly communication and scientometrics. Sugimoto has published more than 50 journal articles on this topic and co-edited (with Blaise Cronin) the monograph, *Beyond*

Bibliometrics, exploring the future of research in the area. Her work has been presented at numerous conferences, and she has received research funding from the National Science Foundation, Institute for Museum and Library Services, and the Sloan Foundation, among other agencies. Sugimoto is actively involved in teaching and service and has been rewarded in these areas with an Indiana University Trustees Teaching award (2014) and a national service award from the Association for Information Science and Technology (2009). Sugimoto has an undergraduate degree in music performance, an MS in library science, and a PhD in information and library science from the University of North Carolina at Chapel Hill.

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