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Much Obligated: Analyzing the Importance and Impact of Acknowledgements in Scholarly Communication

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According to Robin P. Peek, co-founder of the Open Access Directory and associate professor at the Simmons Graduate School of Library and Information Science, scholarly communication through the dissemination of journals was first reported in 1665 (Peek & Newby, 1996, p. 5). However, it took 337 years for the scholarly community to formalize a global initiative declaring research a public good, with unrestricted, free access for everyone. The 2002 *Budapest Open Access Initiative* ushered in a paradigm shift in the way scholars create and share knowledge. The launch of the *Directory of Open Access Journals* (DOAJ) in 2003 formalized an alternative venue for scholars to publish their work. From 2004 to 2010, the number of titles listed in the DOAJ rose from 1,250 to more than 5,200 (Walters & Linvill, 2010, p. 372). Today, the *Scholarly Publishing and Academic Resources Coalition* (SPARC) continues to work as a catalyst for new models of scholarly communication, working in the fields of author rights, digital repositories, and open data.

As the model of scholarly communication evolves and shifts, so too has the field of bibliometrics. *The Open Citation Project*, a joint NSF-JISC International Digital Libraries Research Programme funded initiative, has been analyzing citation counts in open access repositories, impact factors of open access journals, and the role of preprints in the dissemination of knowledge since 1999. The growing field of altmetrics is currently developing alternative models to traditional citation indices, such as the h-index, and beginning to study the role of Zotero and Mendeley within the context of scholarly communication. These new approaches to scholarly metrics are uncovering the broad intellectual networks contributing to a single journal article, well beyond the bibliography. As a corollary, the persistent myth of the lone scholar working in a silent, secluded office surrounded by books and articles is slowly eroding.

Academic libraries have been at the center of many of these endeavors, often pushing open access initiatives on their campuses, building digital repositories, hosting Zotero workshops for faculty and students, and assisting scholars in negotiating author rights for their work. Libraries are pivotal nodes in almost every intellectual network. However, even with the development of new metrics in paratextual evaluation, the work of libraries and librarians continues to be obscured. This is because the libraries lurk in the most overlooked paratextual element: the acknowledgement.

What this paper argues is that the acknowledgments are a crucial but overlooked aspect of scholarly communication and bibliometrics. Not only would a comprehensive analysis of acknowledgements provide a more accurate description of intellectual networks, further eroding the myth of the lone scholar, but it would also quantify and illuminate the importance of libraries and librarians in the scholarly communication process. As a corollary, tenure-track librarians should include research acknowledgments in tenure and promotion reports in order to demonstrate their contributions to scholarship.

History of Paratextual Scholarship

There has been a growing interest in the paratextual elements of scholarly communication in the last decade. Formal elements of documentation, footnotes and citations in particular, have become the subject of entire treatises on expressions of intellectual debt.(Grafton, 1997; Hauptman, 2008; Zerby, 2002). Marginalia, written comments or annotations in the margins of manuscripts, in addition, have been examined quite thoroughly by H.J. Jackson's *Marginalia: Readers Writing in Books* (Jackson, 2001). Scholars in this field have largely focused on the functional attributes of paratextual elements as expressions of intellectual debt. As Sir Anthony Grafton writes about the use of footnotes in historical scholarship, "First, they persuade: they convince the reader that the historian has done an acceptable amount of work, enough to lie within the tolerance of the field. Second, they indicate the chief sources that the historian has actually used...they often give the reader who is both critical and open-minded enough hints to make it possible to work this out - in part. No apparatus can give more information -or more assurance - than this"(Grafton, 1997, p. 22).

Paralleling an interest in the historical function of footnotes and citations is the development of a science, or method, to measure productivity and assess impact in a field: bibliometrics (Andrés, 2009; Bailin & Grafstein, 2009; De Bellis, 2009). This field of study employs quantitative and statistical analysis to identify publication patterns within a field of research or body of knowledge. Three of the most commonly used laws in bibliometrics are Lotka's Law (describing the frequency of publication by authors in a given field), Bradford's Law (determines the number of core journals in a given field), and Zipf's law (predicts the frequency of words within a text) (Potter, 1988, p. 238).

A sub-field of bibliometrics with a particular emphasis on citations and footnotes is *citation analysis*. This field attempts to uncover relationships between authors based on models of co-authorship, shared fields of research, and number of times cited. Derived from this sub-field is the concept of an *impact factor*, measuring the number of times an author's work has been cited as a metric to assess the merits of that individual's contributions to a given field. Coupled with advances in technology and automated extraction of paratextual elements from scholarly articles, citation analysis has become a standard measurement tool of scholarly output through the pioneering work of Eugene Garfield and the development of the *ISI Web of Knowledge* (Garfield, 1979). This citation indexing tools allows researchers to assess their impact in the field by revealing the number of times an article has been cited. In recent years, the citation analysis market has expanded with the creation of citation indexing tools by *Scopus* and *Google Scholar*.

Intellectual Networks

Though paratextual elements provide both credibility and an assessment of impact in the field, underpinning both the historical interest and bibliometric study of paratextual elements is a sociological approach to knowledge that seeks to uncover intellectual networks. Both citations and footnotes are expressions of

intellectual debt that bring authors into conversation with one another and provide insight into the genesis of an idea and the influential players responsible for its creation, extending well beyond the author. As a corollary, webs of intellectuals often form around a question or idea, often arguing with and against one another. These webs of interactions become networks of scholarly communication and provide a more robust view of how ideas are shaped, abandoned, and adopted. Randall Collins, in the preface to his landmark text on the sociology of philosophies writes, "I am arguing that if one can understand the principles that determine intellectual networks, one has a causal explanation of ideas and their changes. In a very strong sense, networks are the actors on the intellectual stage" (Collins, 1998, p. xvii). As a corollary, tools such as ISI Web of Knowledge, Scopus, and Google Scholar allow us to identify networks of activity by contextualizing the influence of a particular journal article by examining both the citations it contains as well as the number of articles citing it. In this way, the concept of *influence* has been operationalized into a measurable variable (a citation) that provides clues to where ideas come from.

Intellectual networks, however, are complex entities that are difficult to uncover through mere citation analysis. Though a peer-reviewed journal article is the end product of research, the formal structure of textual submission (listing co-authors, citing source) conceals the expanded networks of actors responsible for the creation of a single piece of scholarship. Mentors, teachers, librarians, and colleagues all contextualize the intellectual network of an individual scholar. To prove this point, Kevin Dunbar, a psychologist at McGill University, monitored the working environment of scientists at four leading molecular biology labs. After monitoring the video, and conducting interviews with scientists in the lab, Dunbar concluded that ideas were rarely formed in isolation. Rather, group interactions between scientists sitting around a conference table brought ideas into sharper focus and assisted individuals in forming their individual experiments. Summarizing this study in his book *Where Good Ideas Come From*, Steven Johnson writes, "Dunbar's research suggests one vaguely reassuring thought: even with all the advanced technology of a leading molecular biology lab, the most productive tool for generating good ideas remains a circle of humans at a table, talking shop" (Johnson, 2010, p. 61).

Knowledge and Social Practice, or, The Myth of the Lone Scholar

The concept of knowledge production as a social practice should not come as a surprise to anyone in the field of education in the last few decades. Group work and collaborative research has become the foundation of many courses from kindergarten to college. Yet, our current mode of intellectual production (peer-reviewed journal articles) perpetuates the myth of the lone scholar working in isolation with nothing more than a pen, paper, and the necessary books and articles at her disposal. The persistence of this viewpoint can be traced back to the Western philosophical tradition and the dawn of the Enlightenment that upheld the individual as the lone bearer of knowledge. A looming figure in the field of science, René Descartes forever linked knowledge to the lone individual when he wrote

cogito ergo sum, localizing knowledge to the individual mind and viewing the external world with extreme doubt (Descartes, 2003).

Patricia A. Sullivan credits Descartes for popularizing the myth of the lone scholar when she writes, “These [Cartesian] themes were incorporated into the rules and procedures of scientific method, and eventually into the academy, they became the test or measure of the knower” (Ebest, Fox, and Bleich, 1994, p. 14). It does not require much intellectual dexterity to see how journal articles, end products of the intellectual enterprise, are a derivative of lone scholar tradition. Almost all academic journals insist upon publishing pieces of original thought that are the sole intellectual property of the owner. As a consequence, authors are only required to cite the relevant scholarly works consulted in order to demonstrate the originality of their thought against previous scholarship on the topic. While citations and references provide an adequate structure from which one may deduce the originality of research, it does little in demonstrating the vast networks of interaction that shape an idea. Current bibliometric studies record a type of conversation with other scholars and contextualize scholarly work but fail to capture the totality of scholarly communication process. Succinctly, intellectual debt is not only paid in citation, but in mentorship, teaching, collegiality, and oral transmission.

How does one capture these expansive and informal networks of social interactions such as lunchtime chats, departmental meetings, and student interactions that help shape an idea? The answer lies in an often overlooked and non-required paratextual element: *the acknowledgement*. These expressions of intellectual debt, though not required, provide the necessary information in ascertaining the scope of a single author’s intellectual network. As Robert Hauptman writes in his historical overview of documentation, “acknowledgment is often tendered because the person really is grateful and wishes to offer thanks for the idea or stimulus that has helped bring about the new recitation or work” (Hauptman, 2008, p. 8). Within a single acknowledgement, one might find gratitude expressed towards funding agencies, colleagues, students, friends, and even family members. As a courtesy, acknowledgements reflect individual contributors that may not have any publication on the topic of discourse contained within the paper. This expands the network of influence well beyond mere publications. Moreover, because acknowledgements exist within the formal structure of scholarly papers, they can be extracted and analyzed in a similar way to citations. Acknowledgement analysis, coupled with citation analysis, will bring us closer to understanding the principle actors who comprise intellectual networks.

The Scholar’s Courtesy

Whereas Eugene Garfield is a seminal figure in the field of citation analysis, Blaise Cronin, Rudy Professor of Information Science in the School of Library and Information Science at the University of Indiana, is the seminal figure in the field of acknowledgement analysis. In the early 1990s, Cronin began pioneering work in capturing acknowledgements in *the Journal of Documentation* (Cronin, 1991). Essentially, Cronin argued that influence was operationalized as acknowledgement.

Cronin began work on the importance of acknowledgements in uncovering hidden influences, and, as a corollary expanding the intellectual network surrounding scholarship. A culmination of his early work is best summarized in his book, *The Scholar's Courtesy: The Role of Acknowledgement in the Primary Communication Process*. Musing on the historical privilege accorded citations over acknowledgements, even though both signify a relationship, Cronin writes, "the citation has objective status...can refer to the cited document...the personal acknowledgement describes an inherently private interaction, which, by definition, cannot have the same commodity status" (Cronin, 1995, p. 21).

Exploring the acknowledgement behavior in the fields of information science, humanities and social sciences, sociology, and library and information science journals, Cronin laid the framework for the method of acknowledgement extraction and organization. Understanding the complexity of assessing influence, Cronin wrote, "if some acknowledgements are to be treated as indicators of intellectual influence, or used as coordinates to map informal communication ties...it may be necessary at the outset to distinguish clearly between the motivations which underpin different categories of acknowledgement" (Cronin, 1995, p. 41). Creating a six-part typology, Cronin classified extracted acknowledgements into types of support (Cronin, 1995, p. 42):

Paymaster	(grants, Scholarships, fellowships)
Moral Support	(institutional backing, access to facilities)
Dogsbody	(editorial support, data entry)
Technical	(programming advice, statistical assistance)
Prime mover	(mentorship, project director, adviser)
Trusted Assessor	(feedback, critical analysis, provision of insight)

Of the six categories, the *trusted assessor* is considered the most important category and is often referred to as *peer interactive communication*. While the five other categories of acknowledgement are necessary figures in scholarly production, peer interactive communication represents a more intimate relationship in the formation of an idea and thus speaks directly to the scholarly network surrounding an individual network. This typology has been reproduced in many variations, sometimes combining prime mover and trusted assessor, but the basic structure remains unchanged.

Automatic Acknowledgement Indexing

Historically, the extraction of citations and other paratextual elements has been a time and labor-intensive practice, requiring an organization to pay employees to create citation indices by hand. Early iterations of the Institute for Scientific Information Index were compiled in this manner. Perhaps due to time constraints, acknowledgements were not indexed due to their lack of impact and importance. However, automated systems of extraction, often in the form of intelligent algorithms, developed in parallel with the digital repository. This

technique increased the scope of citation extraction to include footnotes and acknowledgements.

In 2004, with support from the National Science Foundation and Microsoft Research, C. Lee Giles, professor at the College of Information Sciences and Technology at the Pennsylvania State University, and Isaac G. Council, then doctoral student in the School of Information Sciences and Technology at the Pennsylvania State University built one of the first automated acknowledgement extraction algorithms. Both as a test of the methods efficacy and an expansion of Cronin's work, Giles and Council applied the algorithm to the CiteSeer database in an attempt to extract acknowledgements automatically. CiteSeer is a scientific literature digital library and search engine that focuses primarily on the literature in computer and information science (The Pennsylvania State University, 2004). The technical details of how these two researchers used a combination of regular expression and a Support Vector Machine for identification and extraction can be found in the proceedings of the International Conference on Knowledge Capture (Council, Giles, Han, & Manavoglu, 2005). The results of their study were published in the Proceedings of the National Academy of Sciences of the United States of America (Giles, Council, & Gray, 2004).

Succinctly, Giles and Council applied their algorithm to approximately 335,000 research documents and extracted over 188,052 acknowledgements ranging from funding agencies, companies, educational institutions, and individuals (Giles et al., 2004, p. 17601). Given the requirement for researchers working within a university on grant-funded projects to acknowledge both the institution and the funding agency, it is not surprising that the overwhelming majority of acknowledgements were in this form. Analyzing the results through a comparative analysis, however, they discovered that only seven educational and seven companies were acknowledged more frequently than an individual researcher, Olivier Danvy, a faculty member in the Department of Computer Science at Aarhus University. Moreover, the study revealed that the "number of citations to the most acknowledged individuals does not correlate well with the number of acknowledgements to those individuals" (Giles et al., 2004, p. 17603). Danvy proved to be a trusted assessor, central to a vast intellectual network, but not highly cited. Giles and Council, in addition to proving the efficacy of their algorithm, successfully revealed the complexity of intellectual networks. As mentioned earlier, mentors and colleagues all contextualize the intellectual network of an individual scholar, but they may not be represented in mere citation analysis. This point was not lost on the researchers as they concluded their study by suggesting that educational institutions should "reward highly acknowledged researchers with the deserved recognition of significant intellectual debt" (Giles et al., 2004, p. 17604).

Acknowledgments and Librarian Tenure

Since 1911, tenure and faculty status for librarians has been debated in higher education (Massman, 1972). The debate continues today. Catherine Coker, Wyoma vanDuinkerken, and Stephen Bales provide a wonderfully concise historical overview of the tenure battle for librarians (Coker, Van Duinkerken, & Bales, 2010).

Nevertheless, many librarians find themselves on a tenure-track, often with different requirements than tenure-track faculty members. As stated in the Association of College and Research Libraries' 2010 *Guidelines for the Appointment, Promotion and Tenure of Academic Librarians* evidence for promotion may include "activities related to inquiry and research: for example, scholarly publication, presentation of papers, reviews of books and other literature, grants, consulting, service as a member of a team of experts, or other means of disseminating professional expertise" (ACRL, 2010). In practice, however, guidelines vary by institution. A 2009 survey of tenure-track librarians reported that many librarians are given "no specific guidelines or benchmarks for promotion and tenure by their institutions" (Garner, Davidson, & Schwartzkopf, 2009, p. 206).

The vagueness of tenure guidelines for librarians is both a challenge, often accompanied with anxiety, and an opportunity. The challenge comes in crafting a tenure portfolio that mirrors those of "teaching" faculty while balancing additional library demands across cataloging, collection development, reference, circulation, and library instruction. Librarians often focus their efforts on publishing in LIS and disciplinary journals, chairing national committees within professional organizations, and presenting at professional conferences in an attempt to explicate "the conviction that academic librarians are not clerks but scholars, and thus deserving of full academic citizenship" (Coker et al., 2010, p. 417). In an attempt to prove equal standing within the academic environment, librarians tend to trumpet their prowess as traditional scholars, while downplaying their uniqueness as trusted assessor. As a corollary, librarians obscure their substantial role in contributing to intellectual networks on their respective campuses and across the globe.

Unspecified tenure guidelines allow librarians an opportunity to illuminate their prowess not only as researchers and authors, but also as important nodes in the process of scholarly communication. Librarianship is often conceived of as a *profession of practice*, manifest in the daily curation and dissemination of information. The daily reference transaction or research consultation is noted, if at all, as a single statistic to be compiled into an annual report at the end of the fiscal year. It's not easy to see where this essential aspect of librarianship fits into a weighted tenure formula of 40 percent teaching, 40 percent research, and 20 percent service. However, this *practice* is an essential component of the scholarly communication process. Contained within the daily practice of librarianship is, according to Steven Johnson, the most productive tool for generating ideas – the research consultation. Though not all reference transactions with a scholar result in publication, many do. The *acknowledgement* is the quantifiable element of intellectual debt expressed by the scholar to the librarian or library.

Revisiting Cronin's typology of acknowledgements, it is conceivable that many librarian acknowledgments would fall in the category of prime mover or trusted assessor, depending on the depth of research consultation. A formalized capturing and categorization of acknowledgements provides librarians with the opportunity to demonstrate their importance in the peer interactive process of scholarly communication. The inclusion of acknowledgments in library tenure portfolios would give a clearer picture of impactful intellectual contributions that

span well beyond the published paper or committee appointment, and comprise a significant aspect of library practice.

Conclusion

A recent discussion in the page of *Nature* centered on the primacy of authorship, against the equally necessary contributions by collaborators, as sole domain of credit. With the emergence of big, collaborative science, the authors push for a more inclusive format for recording contributions, from statistical analysis to data archiving. The authors write, “through the endorsement of individuals’ contributions, researchers can start to move beyond ‘authorship’ as the dominant measure of esteem” (Allen, Scott, Brand, Hlava, & Altman, 2014, p. 312). As intellectual networks expand in size and scope, across disciplines and traditional forms of scholarship, in an attempt to answer increasingly complex questions, the myth of the lone scholar will itself become a footnote of intellectual history. This evolving, communal approach to knowledge construction opens up new opportunities for librarians to demonstrate their crucial role in the scholarly communication process. As Coker et al. point out, “Too often, we librarians are at fault for being overly self-effacing in our work” (Coker et al., 2010, p. 418). As a profession of practice, librarianship prides itself on being a permanent, intellectual foundation upon which education is enacted. However, a closer examination of acknowledgements would demonstrate that librarians are trusted assessor across intellectual networks, worthy of recognition, acknowledgement, and tenure.

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