

Do Bibliometricians Cite Differently From Other Scholars?

Donald O. Case and Joseph B. Miller

College of Communications and Information Studies, LCLI 341, University of Kentucky, 500 South Limestone, Lexington, KY 40506-0224. E-mail: dcase@uky.edu

Why authors cite particular documents has been the subject of both speculation and empirical investigation for decades. This article provides a short history of attempts to understand citation motivations and reports a replication of earlier surveys measuring reasons for citations. Comparisons are made among various types of scholars. The present study identified six highly cited articles in the topic area of bibliometrics and surveyed all of the locatable authors who cited those works ($n = 112$). It was thought that bibliometricians, given that this is their area of expertise, might have a heightened level of awareness of their own citation practices, and hence a different pattern of responses. Several reasons indicated by the 56% of the sample who identified themselves as bibliometricians differed in statistically significant ways from nonbibliometricians, and also from earlier samples of scholars in Communication and Psychology. By far the most common reason for citing a document is that it represents a genre. A factor analysis shows that 20 motivations, clustered in seven factors, can represent the most common motivations for citation. The implications of these findings are discussed in the light of recent debates about the role of social factors in citation. Alternative methods for investigating citation behavior are discussed.

Introduction

The issue of why authors cite one another has been the subject of both speculation and empirical study for more than three decades. Obviously writers may cite documents that they consider generally relevant to their topic, which provides useful background information, and which acknowledges intellectual precedents—a “normative” theory of citation (Merton, 1957). Yet some scholars have long argued that the decision to cite another document is also guided by self-interest (e.g., Leopold, 1973), a tendency to cite documents

supportive of their own conclusions (Ziman, 1968), and written by noted authorities (Kaplan, 1965)—a “persuasive” citation strategy (Gilbert, 1977).

Over the years a variety of reasons for citation have been suggested by scholars, based on close reading, speculation, and empirical measures. Among the various typologies of citation motivations are the 15 reasons identified by Garfield (1965), 28 by Lipetz (1965), 26 by Duncan, Anderson, and McAleese (1981), and the variety of smaller (e.g., 7 to 10 types) typologies reviewed by Cronin (1984) and Cano (1989). All of these were considered in the development of the study described below.

The degree to which we can study an author’s decision to cite another document has been debated for many years. Investigating motivations for citing poses epistemological and methodological problems. What can we assume about the nature of bibliographic citations? Do they express simply a relationship between two documents and the ideas they contain? Or might authors have other, perhaps more personal, motivations that cannot be easily captured? Cronin (1984, p. 57) argues that “the process is not amenable to scrutiny . . . attempts to expose personal motivations are likely to founder, for the simple reason that it is the results, not the process leading up to citation selection, which authors are likely to recall if questioned directly on their practices.” MacRoberts and MacRoberts (1984, 2010) are also skeptical that motivations can be understood using any method of investigation.

Nevertheless, a number of investigators have attempted to study the motives behind citation, using a variety of methods (discussed below). One issue such studies have uncovered is that citation practices vary by type of scholar. For example, in a review of several studies across different academic fields, Harwood (2009, p. 515) notes that “citation functions and motivations are likely to vary from discipline to discipline,” pointing to earlier findings by Small (1982), Peritz (1983), Brooks (1985), and Thompson (2001). In addition to disciplinary patterns, Harwood’s own study found great variation *within* the two disciplines investigated (Computer Science and Sociology).

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In contrast to Harwood's work, Snyder and Bonzi (1998) found no substantial differences in citation motivations among 51 authors in various natural science disciplines, perhaps due to methodological differences between the two studies. Perhaps it is also the case that scientists are more homogeneous than scholars from the social sciences or humanities. In addition it could be, as White (2001) discovered, that citation practices are to some degree idiosyncratic. Yet one thing is clear from all of these discussions: we have few data on stated (as opposed to inferred) motivations that allow for direct comparisons among scholars in various disciplines. The present study is one that will attempt to address that lack of comparative data.

Obviously the broader topic of citation motivations, including differences by discipline, is a complex one, deserving of a book-length manuscript in itself. For a detailed discussion of these issues and their history, the reader is referred to reviews in the following works: Borgman, and Furner (2002); Bornmann and Daniel (2008); Cozzens (1989); Cronin (1998, 2008); Davis (2009); Leydesdorff (1998); Liu (1993); and Luukonen (1997).

Methodological Choices in Studying Citation Motivations

Investigations of citation behavior have tended to rely on one of three approaches: content or context analysis of citing papers to create a roster of reasons for citation motivations, without consulting the author (e.g., Chubin & Moitra, 1975; Cozzens, 1985; Moravcsik & Murugesan, 1975; Oppenheim & Renn, 1978; Oppenheim & Smith, 2001; Small, 1982); surveys of authors, using self-administered questionnaires containing a roster of possible reasons (some of them developed from exploratory interviews with authors), such as used by Case and Higgins (2000), Shadish, Tolliver, Gray, and Gupta (1995), Bonzi and Snyder (1991), Vinkler (1987), and various others; and in-depth interviews with authors, in which they discuss their citations while re-reading one of their own journal articles or book chapters (e.g., Brooks, 1985, 1986; Harwood, 2008, 2009; White & Wang, 1997). A potential fourth method is for the investigator to be present at the side of the author while he or she is drafting a paper and recording citation decisions while they are being made; while offering rich data, this approach has not been used in citation studies, probably due to problems associated with its obtrusiveness as a method.

Each of these methods has its advantages and drawbacks. Content and context analysis is unobtrusive, and thus avoids issues of reactivity (e.g., socially desirable responses) that come with questioning the original author; however, the document analyst may make judgments that differ a great deal from the intentions of the original author of the document examined. Surveys of authors have the advantage of consulting the original author about their intentions; however, the categorizations of motivations on the questionnaire may not exactly match those of the responding authors. In addition, surveys make use of items published long enough ago

to have garnered citations, the age of these articles requires the author to recollect their motivations at the time, which raises issues of reliability. Finally, interviews can elicit more lengthy responses about citation practices than can surveys, but like surveys they are affected by the reliability of informant recall and may intensify the reactivity of the response (i.e., providing socially desirable answers), Harwood (2009, p. 517) notes that the varying degree to which respondents are willing and able to introspect can also be a confounding factor in interviews. However, each of these methods suffer from sampling problems. The first two methods can achieve large samples of articles, authors, and/or citations, while the interview approach is typically limited to small samples of authors (e.g., between 12 and 26 in the studies cited above). Overall, the weakest method may be content analysis, as it requires that investigators impose their own classification on reasons for citation.

The Present Investigation

This article reports on recent studies of motivations for citation through the use of self-administered survey instruments. The present study is a replication of earlier studies conducted in 1999 and 1995, with minor changes to instrumentation. Although the results of these earlier studies suggest that a few of the questionnaire items are not especially useful, we decided to replicate the 1999 instrument in order to make more exact comparisons among the studies. As these earlier studies were conducted via postal mail, the major difference in this investigation was implementation via the Web, in which it was possible to reach larger numbers of authors, especially in nations outside North America. So the international composition of this sample is also an improvement on the 1995 and 1999 studies; while the anonymous nature of the results precludes knowing for certain, based on email country domain codes or institutional affiliations we can estimate that roughly 72% of the sample population lived outside of the United States.

A survey instrument was prepared (see Appendix B) using a comprehensive list of 31 reasons for citation drawn from two earlier studies of citation practices (Case & Higgins, 2000; Shadish et al., 1995), with one item ("...unusual or especially innovative") repeated in a varying form as a partial check on reliability. In addition, the survey included 10 background questions (e.g., "Would you consider the author a personal friend?"). The main 32 items consist of a series of Likert scales, such as the example below, reflecting reasons for citing another author's work:

This reference is a classic reference in the field.
Agree 1 2 3 4 5 Disagree

The instrument used was based on that developed by a group of psychologists, Shadish et al. (1995), who used it to conduct two surveys in the discipline of Psychology. Their starting point was the assumption that citation practices could be studied "by locating a highly-cited work and then asking different authors about why they have cited it" (1995, p. 495).

The initial roster of 28 questionnaire items they developed were based on interviews with academic authors, along with suggested reasons from earlier studies of citation practices and the commentaries of sociologists of science. We added items suggested by the results of their studies, as well as eliminated one that proved to be too general and hard to interpret (which Shadish et al. also dropped from a later investigation); we also added an additional background question about coauthorship. Relatively few ($n = 26$) unique responses were supplied in response to an open-ended “other reason” question, and at least nine (35%) of these duplicated one of the 31 items of the roster; this pattern suggests that the instrument was reasonably exhaustive of motivations for citation.

Survey Procedures and Return Rate

The object of the study was to sample a group of citing authors with an interest in bibliometric or scientometric research. It was hypothesized that bibliometricians, given that this is their area of expertise, might have a heightened level of awareness of their own citation practices, and hence might provide distinct responses to a survey about reasons for citation. To arrive at a sample of authors, six target (i.e., highly cited) articles were selected (through the ISI Web of Science [WoS] database) on the basis of having the following characteristics:

- addressed bibliometric topics (e.g., citation rates, citation mapping, co-citation, or impact factors);
- published recently enough to facilitate recall of the circumstances under which it was cited; and
- relatively highly cited for the length of time it has been in print (e.g., cited more than four times per year, over at least 7 years).

Six articles meeting these characteristics were selected, published between 1995 and 2002 (a seventh, older article was discarded from the investigation after initial respondents told us it was too long ago to recall the circumstances of their citation of it). Thus, the target articles appeared during a period of between 7 and 14 years before the study commenced. Each had earned between 50 and 211 citations during the period in which it had been available to be cited; the average annual rate of citation varied among the six articles from 4.5 to 19.2 cites per year. Three of the articles appeared in the (then-entitled) *Journal of the American Society for Information Science*, two in *Scientometrics*, and one in the *Journal of Information Science*. See Appendix A for a list of the six articles used to generate the sample of citers.

In June of 2009 authors and coauthors of all citing articles were identified, again using the ISI WoS database, which was deemed a more authoritative source of citation information than options such as Google Scholar. WoS datasets of citing authors were exported to the Endnote program. Email addresses were gathered from the WoS citation record if available, or by searching the author’s affiliated institutional Website or the open Web. In a few cases we were unable to locate any email addresses for an author; in 18 cases an author appeared multiple times in the sample and duplicate entries

were screened out, so that their information would only be requested once. Thus, the final population we attempted to sample was 532 citing authors.

Email requests, with a link to a survey site, were sent out in late June, 2009, with a second (reminder) copy emailed about 3 weeks later. Of the 532 emails sent out, 78 turned out to be invalid email addresses (even after some second attempts with different addresses), leading to a final sample of 454. A total of 112 were returned over the 5-week period, leading to a response rate of 24.7%. The response rate was consistent among the cited articles, for which the return rates varied less than four percentage points in either direction (i.e., 21–28%).

As the survey was anonymous, we have no way of knowing what types of authors did not respond; however, given the complex nature of some questions it is likely that a number were authors for whom English was not their first language; in addition, most of the authors for whom addresses could not be obtained were Asian, leading to likely undersampling of that population.

Results were analyzed using SPSS v. 18.0 (Chicago, IL).

Results

Sample Characteristics

The citing authors contacted in this investigation were given an opportunity to check any number among 12 possible “disciplines, fields or research areas” to which they belonged. Consequently, nearly all of the final response set of 112 respondents reported multiple disciplinary affiliations. The most popular of these were: information science (52.7%), bibliometrics (43.8%), scientometrics (39.3%), social/behavioral sciences (38.4%), informetrics/webometrics (25.9%), and library science (24.1%). No other single discipline or field was reported by more than 11.6% of the sample; however, it is likely that most of these latter respondents were scientists of some kind (i.e., physical, biological, or medical). See Table 1 for a comprehensive listing of disciplinary affiliation. From cross-tabulations of these data it is clear that the various “metrics” terms overlap heavily, with 56.3% of the sample choosing one or more of those

TABLE 1. Most common disciplinary affiliations of respondents ($N = 112$).

Discipline Descriptor Chosen by Respondent (Multiple Choices Allowed)	Percent of Sample Choosing Descriptor	Percent Choosing One or More “Metric” Disciplines
Bibliometrics	52.7	} 56.3
Scientometrics	39.3	
Informetrics	25.9	
Information Science	43.8	
Social/Behavioral Science	38.4	
Library Science	24.1	
Physical Sciences	11.6	
Medical/Health Sciences	10.7	
Computer Science	10.7	
Biological Sciences	7.1	
Humanities	3.6	

TABLE 2. Percentage of affirmative responses to questions about relations of citing to cited author: comparison of three studies (by discipline, year, sample size).

Relationship to cited author or item	Whole sample (2009) (<i>N</i> = 112)	Communication (2000) (<i>N</i> = 56)	Psychology (1995) (<i>N</i> = 192)
Have you ever spoken directly (or phone or email) with the author?	42	46	45
Would you consider the author a personal friend?	13	23	18
Is the author a colleague at your institution?	3	2	9
Did the author work at an institution where you were trained?	4	20	10
Did a journal referee/reviewer ask you to include this . . . reference . . . ?	2	5	3
Have you ever coauthored a document with this author?	5	16	*
Have you ever read this reference?	97	98	95
Did this reference appear in the journal in which your article appeared?	27	13	17
Do you subscribe to the journal in which this reference appeared?	42	38	28

Note. Percentages above are rounded up to the nearest whole number, both in the interest of readability and because some samples are smaller than 100. Percentages mentioned in the text will reflect decimals where appropriate.

*Question not asked in that investigation.

labels (bibliometrics, scientometrics, and/or informetrics) to identify their research interests. Eighty-four percent of those choosing “scientometrics” as an affiliation also chose “bibliometrics,” as did 69% of those indicating “informetrics/webometrics” as a research interest. For the sake of brevity we will henceforth refer to all three genres of research with the label of “bibliometrics.”

These disciplinary affiliations will be used later on in this report in various tests as to whether bibliometricians have similar citation motivations to nonbibliometricians.

Relationship Between Citer and Author

Respondents were asked five questions about their relationship to the cited authors (see Table 2). Forty-two percent had spoken to the cited author at some time, and 12.7% considered the author to be a friend; 5.4% had coauthored a document with the cited author (less than a third of the coauthorship rate discovered in the survey of Communication scholars), 3.6% had studied at the same educational institution, and 2.7% had worked at the same institution as the cited author. As can be seen from Table 2, the circumstances of this sample do not differ radically from samples taken from Communication or Psychology in most respects. The most important differences may be fewer reports of friendships with the cited author, and less likelihood to have worked or trained at the same institution as the cited author; possibly this reflects the more international sample of this survey as compared to the two earlier surveys. As discussed below, comparing the subset of respondents who considered themselves to be bibliometricians to the rest of the sample revealed few differences in these “social proximity” items, except that

the bibliometricians were twice as likely to have spoken to the author(s) they cited (54% vs. 27%) as were the rest of the sample.

Johnson and Oppenheim (2007, p. 627) also point out the tendency for more citations to be “made to work authored by social contacts”; certainly in such a small field of investigation as bibliometrics it is not surprising that citing authors have had contact with the cited author. To explore this issue further, we created a “social closeness” index (ranging from 0 to 3 in value) based on affirmative answers to the first three questions in Table 1 (i.e., have contacted the author, consider author a friend, and/or work at the same institution as the author). We correlated this index with the 31 unique motivations of the questionnaire, and found statistically significant associations with six of the citation motivations. As social closeness to the author increased, there is a greater tendency to rate authoritativeness of author, quality of cited work, and prestige of journal more highly, and to rate three of the “negative” items less highly (that the work is flawed, that it contradicts one’s own work, or that it uses old methods). So befriending, speaking, and working with a cited author do correlate with some of the answers to the motivational questions described below. However, it is not clear that it is a simple case of cause and effect, resulting in a bias; it could be, for example, that having admiration for the work of another scholar makes one predisposed to contacting, befriending, and/or working with the author later on—in which case it is not that closeness comes first in time, and opinion later on. This more subtle view of social influence is described by White, Wellman, and Nazer (2003) in their study of intercitation among a research group; they note (p. 125) that “Were the explanations simply social, then ties that are content neutral,

TABLE 3. Most highly-ranked reasons for citing another document: percentage of respondents listing items as “most important” reason across three studies (discipline, year, and sample size).

Item reflecting reason for the citation	Whole sample (2009) (N = 112)	Bibilometrics (2009) (N = 63)	Communication (2000) (N = 56)	Psychology (1995) (N = 192)
This reference is a “concept marker”—it represents a genre of studies, or a particular concept in the field.	20	25	20	16
This reference reviews prior work in this area.	8	5	24	3
This reference documents the source of a method or design feature.	7	7	11	16
This reference helps establish the legitimacy of the topic of your article.	6	2	11	4
This is a classic reference in the field.	6	9	4	9
This reference shows the reader that you are familiar with the important literature of the field.	5	4	0	0
This reference is authored by an authority in the field.	3	4	5	1
This reference illustrates a perspective or finding that contradicts a perspective or finding in your article.	3	0	2	4
This reference has deficiencies that contrast with the strength of your article.	0	0	2	3
This reference supports an assertion in the sentence in which it occurs.*	—	—	—	18

*The original study by Shadish included this item, which they subsequently judged to be too general, and later excluded from their second study (the detailed results of which were not published). Case and Higgins likewise removed the item in their 1999 investigation; had this item not been included in the Psychology results, the percentages would likely be slightly larger for each item listed above.

like friendship . . . would have greater explanatory power than they do.”

Relationship Between Citer and Cited Item

Respondents were asked five questions about their relationship to the cited item (see Table 2). Over 97% claim to have read the cited item at some time, consistent with the earlier studies; 82.9% currently possessed a copy of the cited item; 42.3% subscribed to the journal in which the cited item appeared; 26.8% had published their citing article in the same journal in which the cited item appeared; and only 1.8% (i.e., two individuals) reported being asked to cite the item by a referee for that journal during the reviewing process.

Why They Cite

Respondents were asked to respond to a roster of 31 unique reasons they might cite a document. “Other” (respondent-supplied) reasons were also collected as “most important” in the citation decisions; 14 of these were supplied. In nearly all cases these were more specific examples of one of the questionnaire items, usually emphasizing methodology or review of the literature. Typical examples of “other” responses include “related work,” “review of a methodological approach,” and “good review article.” The fact that so few unique reasons were uncovered in the open-ended responses suggests that the roster included a fair representation of possible motivations for citation.

Overall, the responses of this sample are not widely different from those in earlier studies. Where they tended to differ

was in the strength of their agreement (on the five-point scale) with a few items, particularly those related to “negative” reasons for citation; this will be explored further below. This sample also differed rather markedly from the earlier studies in what they chose as the “most important” reason for citing the document.

Key results of this study are to be found in Table 3, which reports those items that the respondents thought to be “the single most important factor in your decision to cite.”

As can be seen by comparing the responses, the ranking of items is similar to the other two disciplines, but the magnitude of responses is not—except for the most popular reason, which is “this reference is a ‘concept marker’,” chosen by 19.6% of the sample. This finding supports the hypothesis of Small (1978) that a study may stand for an important concept, and thus represent an entire genre of studies, along with their common theories, methods, and findings. As can be seen in Table 3, this was the second-most popular reason among the earlier samples of scholars from Communication and Psychology.

After their top choice, the motivations of the current sample are much more diverse than those of authors in Communication or Psychology. The distant-second most popular motivation was “reviews prior work in the area”; (chosen by 7.8%) and the third “documents the source of a method or design” (6.9%). Following the three top reasons were two others chosen by 5.9% of the sample (“helps establish legitimacy” and “is a classic reference”), then “shows the reader that you are familiar,” chosen by 4.9%. After that, the frequency drops off sharply, with no other items garnering

more than 2.9% of the vote, and 11 items not chosen by any respondent as “most important.” This latter result is significant in that these were items chosen by at least a few of the respondents in the two earlier studies discussed here; these respondents, it seems, are more discriminating in what they will acknowledge as reasons for their citations.

In summary, those who cite bibliometrics literature are much less likely to cite documents that review prior work than were authors in the Communication study, and less likely than psychologists to identify a cited work as a “classic reference” (although it must be acknowledged that the cited articles are relatively recent, which suggests they are less likely to be regarded as “classics”). It may also be notable that the sample in the present investigation had a much smoother distribution of responses, tailing off gradually among the choices (other than the most popular, “concept marker”). Perhaps this reflects a more nuanced view of the reasons one cites items.

Negational Citations

For over half a century much attention has been paid to the idea that citations are not always positive in nature. Anecdotal classification schemes of citer motives imply that criticizing a study is a fairly common reason for citation; for example, fully 20% of Garfield’s (1965) hypothesized 15 reasons for citation were negational in nature. At least one early study seemed to confirm this way of thinking: the incidence of negative citation was 14% in Moravcsik and Murugesan’s 1975 investigation. Frost (1979) and Hellqvist (2010) have argued that citations that criticize are even more common in the humanities, while Harwood (2009) found sociologists much more inclined to negative citations than were the computer scientists in his sample.

Other investigations point to a much lower rate of refuting citations: a content analysis by Chubin and Moitra (1975) found a 5% incidence of “partially negational” citations among physics articles, while Oppenheim and Renn’s (1978) study found only 2% “partially negational” rate among older physics literature. Cano (1989) as well found only a 2% rate of criticizing or refuting citations in her investigation.

As in the Shadish et al. and Case and Higgins studies, this investigation found “negational” types of citation to be rare; not only did these respondents tend to disagree with the four “negative” reasons for citations on the roster of items, only three respondents chose any of those four items as their “most important” reason; in those cases it was the item “This

reference illustrates a perspective or finding that contradicts a perspective or finding in your own article,” which could reflect criticism. We have also included in Table 3 the only other negative item for which we have data from all three studies (“This reference has deficiencies that contrast with the strength of your article”), even though it was not chosen as “most important” by any of the current respondents, to emphasize this relative lack of negative motivations among the 360 individual citers who participated in all three studies.

In sum, the present results demonstrate that “negative citations” are uncommon among the populations sampled. However, we must keep in mind that all three samples were based on highly cited items, and it is likely that these particular documents were cited for their quality rather than their faults. And, as MacRoberts and MacRoberts have pointed out (1984), criticisms in publication are socially discouraged, while White (2001) adds that criticism takes more effort to carry off competently, in contrast to simply agreeing with what another author says.

Are Bibliometricians Different From Other Scholars?

Up to this point the study has discussed the data gathered from a sample of 112 authors who cited one of six bibliometric documents. Now we turn our attention to comparisons between self-identified bibliometricians versus other types of researchers in the sample. We conducted two different comparisons: one by splitting the sample, and another by comparison with an earlier sample.

First, we used the disciplinary self-identification data discussed earlier (portions of which are found in Table 1) to segment the sample into two groups: bibliometricians (the 56.3% of the sample who chose one or more of the three “metrics” labels), versus nonbibliometricians (the other 43.7% of the sample).

Means on the 31 Likert scale items were compared statistically using the *t*-test. Table 4 shows those “reasons for citation” upon which these two groups most differ. The strongest associations are that bibliometricians were more likely to say that this was an item “authored by a recognized authority in the field” ($t = -4.640, df = 107, P < 0.001$), and that it was “published in a prestigious journal” ($t = -3.647, df = 104, P < 0.001$). The other three significant differences might all be considered to be examples of “negative citation”: “illustrates a perspective or finding that contradicts a perspective or finding in your article” ($t = 2.064,$

TABLE 4. Comparisons of motivations for citing another document: *t*-tests of reasons, bibliometricians ($N = 63$) versus nonbibliometricians ($N = 49$).

Item reflecting the reason for the citation	
This reference is authored by an authority in the field.	$t = -4.640 (df = 107), P < 0.001$
This reference was published in a prestigious journal or handbook in the field.	$t = -3.647 (df = 104), P < 0.001$
This reference illustrates a perspective or finding that contradicts a perspective or finding in your article.	$t = 2.064 (df = 103), P < 0.02$
This reference has deficiencies that contrast with the strength of your article.	$t = 2.064 (df = 101), P < 0.02$
This reference is now theoretically outmoded.	$t = 2.165 (df = 103), P < 0.04$

TABLE 5. Logistic regression of yes-no responses to disciplinary affiliation choices, grouped by bibliometrician versus nonbibliometrician.

Predictive variable	Odds ratio	95% Confidence ratio interval (lower-upper)	Significance	Model
This reference is authored by an authority in the field.	1.90	1.75–6.90	$P < 0.001$	$X^2 (2, N = 106) = 27.37, P < 0.001$
This reference was published in a prestigious journal or handbook in the field.	1.53	1.06–2.67	$P < 0.03$	

$df = 103, P < 0.02$), “has deficiencies that contrast to the strength or your article” ($t = 2.064, df = 101, P < 0.02$), and “is now theoretically outmoded” ($t = 2.165, df = 103, P < 0.04$). Overall, the bibliometricians were less likely to criticize the works they cited than were the rest of the sample.

A similar type of analysis is a binomial logistic regression conducted on the two types of respondents in the sample to test if self-identification as a bibliometrician could be predicted on the basis of responses to the 31 scalar items. Logistic regression creates an equation that predicts whether respondents will choose one or more of the labels bibliometrics, scientometrics, or informetrics/webometrics to describe their own research specialty. The results are expressed as an odds ratio, a measure of effect size in which the ratio of the odds of a “yes” response occurring are compared to the odds of a “no” response for the variable examined. An odds ratio of 1 indicates that either response would be equally likely.

Table 5 shows the two most predictive items. Knowing the responses to these two items allows correct classification of 72.6% of the respondents—much better than chance. The strongest predictor was the item “. . . authored by a recognized authority in the field.” The second strongest item was “. . . published in a prestigious journal. . . .” That these variables correctly predicted whether a respondent was a bibliometrician might be due to the greater familiarity of that group with both journal rankings and individual reputations; e.g., a psychologist citing bibliometrics literature might be unaware that *Scientometrics* or *JASIST* are prestigious journals in this field, or that Howard White is a major scholar of bibliometrics. Given the means test described above, it is not surprising that these two items predict identity as a bibliometrician.

Comparisons were also made between the bibliometricians and the Case and Higgins (1999) sample of scholars in Communication, which used the same instrument. Here, however, only two statistically significant differences were found in reasons for citation between the bibliometricians and Communication scholars. Bibliometricians were more likely to say that the article they cited was a “classic” ($t = 2.480, df = 112, P < 0.02$), and to cite for reasons of a method or design feature ($t = 4.186, df = 112, P < 0.001$), than were Communication scholars. The lack of differences between these two samples may be because the social/behavioral science orientation of the Communication scholars (all of whom were quantitative researchers) was congruent with the methods the bibliometrician group (43% of whom also identified themselves as social/behavioral scientists). These two

groups appear to have similar patterns of motivations for citation.

Identifying Underlying Factors in Citation

Again focusing solely on the 63 respondents who self-identified as bibliometricians, various rotated factor solutions were attempted to reduce the 31 reasons for citing to a smaller number of factors. The most parsimonious and sensible solution involved 15 of the 20 variables chosen by at least one respondent as “most important,” plus five other variables influential in terms of their scalar responses. This analysis explained 71.5% of the variance among the chosen variables. The factor solution in Table 6 displays the seven factors with their subscales and factor loadings. The first five of these were similar to the initial five of the seven factors found by Shadish et al., and five of them were also somewhat similar to the first four and final (of seven) factors identified by Case and Higgins. Overall the pattern is closer to that shown in Shadish et al.’s study of psychologists.

The most cohesive factor is formed of the four items representing NEGATIVE reasons for citation. These include disagreement between the citing and cited items, and criticism of the cited item for using outdated methods, theories or for overall weakness. Note that none of the bibliometricians indicated that any of these items reflected the most important type of motivation.

The second factor is comprised of items PERSONALLY INFLUENTIAL, i.e., that the cited document strongly influenced the thinking of the author and/or the choice of method, and hence is similar to the citing item.

SOCIAL REASONS is the third factor. This reflects the citing of a potential reviewer of one’s manuscript, an effort to orient one’s work to the readers and reviewers of the target journal, and an attempt to legitimate one’s work through citation.

The fourth factor is that of citing work that one regards as a CLASSIC, e.g., one that is a “Concept marker,” standing in for a genre of studies, and which exhibited a novel approach. This factor included the two most popular reasons for citation among bibliometricians.

Items indicating creative content such as inspiration for future research, form the fifth factor.

The sixth factor could be considered a second set of “social reasons” for citation. For distinction we call it DEMONSTRATIVE, as it appears to represent a general demonstration of familiarity with the literature of the field, and more

TABLE 6. Bibliometrician citation factors, percent choosing as “most important” item, highest loading items and item loadings (items >0.45).

Factor #	Questionnaire items reflecting motivation for citation	Factor loading
1. NEGATIVE reasons for citing (alpha reliability = 0.79; scale mean = 7.5, SD = 9.1)		
	This reference illustrates a perspective or finding that contradicts a perspective or finding in your article. (0%)	0.84
	This reference is now methodologically outmoded. (0%)	0.83
	This reference has deficiencies that contrast to the strengths of your article. (0%)	0.80
	This reference is now theoretically outmoded. (0%)	0.51
2. PERSONALLY INFLUENTIAL (alpha reliability = 0.71; scale mean = 10.7, SD = 14.2)		
	This reference was a major source of the idea for your article. (2%)	0.83
	This reference strongly influenced your thinking on the topic of your article. (2%)	0.82
	This reference documents the source of a method or design feature used in your study. (7%)	0.70
	This reference reports an article this is similar to your own article. (2%)	0.66
3. SOCIAL REASONS (alpha reliability = 0.60; scale mean = 9.6, SD = 6.2)		
	This reference was authored by someone who might have been influential in the review process. (0%)	0.80
	This reference presents an orientation that is congruent with that of the readers or reviewers for the journal in which your article appeared. (4%)	0.77
	This reference helps establish the legitimacy of the topic of your article. (2%)	0.72
4. CLASSIC (alpha reliability = 0.64; scale mean = 10.6, SD = 5.9)		
	This reference is a “concept marker”—it represents a genre of studies, or a particular concept in the field. (25%)	0.75
	This reference has generated much novel and successful research or scholarship. (0%)	0.70
	This is a classic reference in the field. (9%)	0.66
5. CREATIVE (alpha reliability = 0.67; scale mean = 5.9, SD = 3.6)		
	This reference illustrates possible avenues for future research. (4%)	0.86
	This reference bridges a gap between two subfields. (0%)	0.75
6. DEMONSTRATIVE (alpha reliability = 0.56; scale mean = 12.3, SD = 4.1)		
	This reference was published in a prestigious journal or handbook in the field. (0%)	0.70
	This reference shows the reader that you are familiar with the important literature in this field. (4%)	0.63
	This reference is authored by a recognized authority in the field. (4%)	0.45
7. REVIEW (alpha reliability = 0.44; scale mean = 6.0, SD = 3.3)		
	This reference reviews prior work in this area. (5%)	0.86
	This reference is a reiteration of a position formulated many years before this reference was published. (0%)	0.54

specifically citation of work from prestigious journals and authoritative authors.

The final factor, which is weak, reflects citation of a literature REVIEW, or of an article restating older research findings.

Reliability (Cronbach’s alpha) measures the scales as good to fair, except for the final two factors, in which alpha falls below the usual standard of 0.6. Alternatively, the five items comprising those scales could be treated as independent factors and scored separately; they are retained as factors in this table for economy of space and explanation.

Limitations

As in earlier surveys, three types of methodological problems are intermingled—the sampling frame, the sample size, and the response rate. First there is the issue of the frame used for the sample. The sample population was composed of those authors who cited one or more of six highly cited articles that discussed bibliometric topics. Starting this way allowed us to avoid possible biases that might have arisen from having to identify authors directly, and to allow us to make comparisons between subsamples. An alternative method would have been to begin with a sampling frame that preidentified bibliometricians, such as the membership list of the International Society for Scientometrics and Informetrics (ISSI). We think

that starting with actual citation behavior not only introduces fewer possible biases but allows another basis for comparison, as we also obtain responses from scholars who cite bibliometric literature but do not themselves produce such research.

Second, picking articles that are highly cited by definition makes them different from the less-cited articles that make up the bulk of any literature. Further, in order to generate substantial sample sizes it was necessary to choose articles that had been in print for some time (7–14 years), which could lead to problems of recall.

Finally, the response rate of about 25% raises the issue of unknown nonresponse biases; the response rates from postal versions of this survey ranged from 50% to 68%. We have some evidence that nonspeakers of English, especially those in Asia, were less likely to respond to the survey, but beyond that we do not have a clear understanding of the differences between those who responded and those who did not. It appears plausible, for example, that second-, third-, and nth-authors were less likely to respond because they were less involved in the citation decisions. If that is so, an alternative design would have been to contact only first authors. However, that would have lowered the sample size at the same time as raising the response rate; because the seven items initially chosen were the highest-cited we could identify, to achieve a large sample size using only first authors of citing items would

have required us to use as starting points many more items that had been less-cited, in order to make up the difference in loss of responses from ignoring additional authors beyond the first. Starting with only a few highly cited items is thus problematic when studying relatively small fields of study; it would not be a problem with a larger discipline in which the highest-cited items had achieved hundreds of citations.

Whatever the nature of nonresponse biases, the lower overall response rate is likely due to the impersonal nature of such a method and the ease with which one can ignore or delete a request to answer a Web-based survey; one study that compared survey methods found that postal notices must be used in conjunction with electronic surveys if one is to achieve a response rate comparable to mailed paper questionnaires (Kaplowitz, Hadlock, & Levine, 2004).

In addition, the type of instrument used may have an effect on the results. A long roster of scalar items may encourage set patterns of responses, or inattention to wording. Respondents may be tempted to go down the list and check the central columns. This tendency was tested by duplicating one item in the roster, with a minor change in wording—the “alternative form” method of reliability assessment (Carmines & Zeller, 1979). While the responses to the two similar items exhibit similar means (2.65 vs. 2.75) their correlation is just 0.629—suggesting that some respondents were not responding consistently; an examination of individual choices indicates that the variation originates from just five individuals who chose more extreme responses for the first item than they did for the second, alternate form of the item. We conclude from this that a response set was not a serious problem with the instrument.

The item regarding coauthorship represents a possible bias in the sample: 5% of respondents had, at some point, coauthored an article with the author they cited. This might lead them to be more positive and less critical in their responses, given the personal and professional connection. However, the degree of coauthorship was much less than in the first author’s previous study of Communication scholars (in which it was 16%).

Finally, like interviews, self-administered questionnaires and interviews may suffer from problems of retrospective reasoning, recall, interpretation, and lack of honesty by respondents.

Discussion and Conclusions

This study has addressed the question of whether those who study bibliometrics and related topics are similar to other populations in the manner in which they cite. Making citations the focus of their investigations, and being aware of research findings regarding citation practices, should make bibliometricians more introspective in their own citation practices; in turn, they might emphasize different motivations than did other groups in responding to a survey of this type. In design this investigation was a replication of previous studies (Case & Higgins, 2000; Shadish et al., 1995) in a different discipline—one able to shed some light on the

issue of normative versus persuasive reasons for citation. A self-administered instrument posed 31 unique questions about why a certain document was cited, using an instrument from those earlier investigations of authors in Psychology and Communication. An effort was made to obtain responses from a worldwide sample, in contrast to the largely North American samples of earlier studies.

Starting with a sample of 112 authors who cited bibliometric literature, it was found that the responses of the full sample to a roster of possible reasons for citation were similar to those in two earlier studies (Case & Higgins, 2000; Shadish et al., 1995), yet with several statistically significant differences on individual items. The current sample differed from those studies in their choice of “most important” reasons for citing a document. Overall sample respondents were, like other scholars, likely to cite studies that are “concept markers,” chosen by 19.6% of the sample, but their other motivations were more diverse than those of authors in Communication or Psychology. They were less likely to cite articles for their reviews of previous work, for example.

A stricter bibliometrician subset ($n = 63$) of the sample showed a pattern of responses that were rather different than the rest of the current sample, yet similar to an earlier sample of Communication scholars. Bibliometricians were less likely to cite for “negative” reasons, and more likely to cite a work by a recognized authority in their field. At the same time, these scholars said that those reasons were not, in themselves, terribly important. We conclude that bibliometricians as a group are different from some other scholars, even those citing the same studies. They are not, however, much different in their practices from some social scientists.

In none of these three studies were overtly persuasive reasons given for citing a document, unless we assume that citing an author regarded as an authority is done solely for persuasive reasons.

In this latter point the present investigation touches on a “meta-issue” of great import to the sociology of science: the role of persuasion in scientific writing. For at least 33 years, information scientists and sociologists of science have debated the practice of citation: Does it follow a “normative” (aka “Mertonian”; see Bornmann & Daniel, 2008) model, or a “persuasive” one (often labeled “social constructionist”)? That is, do authors cite the work of other authors for the traditional, “intellectual influence” reasons (topical relevance, giving credit to earlier work, acknowledging a pioneer, documenting a method used, etc.)? Or, do they cite in order to persuade, to make whatever arguments they can, even if it means twisting, misquoting, or perhaps not even reading what is being cited?

The two positions described above are obviously meant to contrast, to appear black-and-white. Nevertheless, they are approximations of the positions outlined by Luukonen’s (1997) article on sociological interpretations of citation analysis, as foreshadowed by Gilbert’s 1977 article on “referencing as persuasion.” Gilbert, a British sociologist, has been particularly associated with the view that discovering results must be accompanied by efforts to convince colleagues of

their importance. Despite being the poster child for the normative view, Merton (Merton & Zuckerman, 1973) himself acknowledged the persuasiveness of citations, in particular he suggested that scientists were more likely to cite the work of already-recognized authorities in order to convince the reader of his or her claim to knowledge. Some attempts to measure motives, such as the investigations by Brooks (1985, 1986) and Kapeson (2004), have found support for the persuasiveness of view.

In general, however, the normative view appears to be making a comeback. Howard White's 2004 article on reward and persuasion claims (p. 93) that "recent evidence from both bibliometric studies and surveys of citing authors run strongly" in support of the normative view; Cronin (2008) and Davis (2009) agree with White's assessment. Nevertheless, the debate continues regarding the role of the role of social factors in citation.

MacRoberts and MacRoberts (2010) have recently argued that citations are outright misleading (and thus hardly worth studying), because they fail to reflect completely either intellectual or social influences. Regarding the more specific topic of citer motivation, other writers suggest that these can simply not be investigated in a reliable way. Some advocate particular methods as more reliable: content or context analyst, questionnaires, or in-depth interviews. This latter approach may be gaining in popularity (e.g., Harwood, 2009).

Questionnaires, such as the one used in this investigation, have been reasonably criticized for providing precategorized motivations to which respondents react. This is true, yet it is important to recognize how such categories are developed and the strengths of this method. These reasons to cite do not simply originate from one or two researchers. Instrument items have been culled from the voluminous literature on the topic, as well as developed from interviews with individual authors; that is how Shadish et al. developed the instruments they used in two studies. Further, two subsequent investigations have been based on theirs, allowing some comparisons to be made. It is certainly possible that such inventories of motivations are not exhaustive; however, the three studies that have used this particular have received few "other" responses that vary from the listed items. Indeed, the factor analyses imply that a smaller set of items (e.g., 20), might suffice to describe the most common motivations.

Although self-reporting of internal psychological processes remains problematic for many reasons, asking authors about their motivations can be a useful starting point for the study of citation practices. The present investigation suggests that surveys can provide some insight into the reasons that authors cite one another, particularly by allowing direct comparisons to earlier work, providing evidence of differences, or lack thereof, in citation motivation among scholars from various disciplines. Notably, results from self-identified bibliometricians were different from nonbibliometricians in the sample, yet similar to Communication scholars. Future work might clarify these results by using the current instrument to survey direct samples of bibliometricians (e.g., from the ISSI membership list) and comparing them to the results of past

studies. A new survey could also include direct background questions regarding the respondent views on the issue of a normative versus persuasive view of citation practices.

Finally, the factor analysis above points the way towards a more parsimonious explanation of motivations for citation. The Shadish et al. solution of seven factors (plus two independent items, for a total of nine) employed 28 variables. Subsequently, the Case and Higgins study used 21 variables to identify seven components. And this study found that 20 variables could be sorted into six factors. Although the final two factors (comprised of five variables) lack high reliability, the earlier studies suffered similar problems with several of their factors. In any event, it could be that a future instrument, using only these 20 items would achieve higher ratings for reliability and uncover a clearer picture of citer motivations.

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Appendix A. Six highly cited bibliometric topics articles used to identify citers.

1. Leydesdorff, L. (1998). Theories of citation. *Scientometrics*, 43(1), 5–25.
2. Small, H. (1999). Visualizing science by citation mapping. *Journal of the American Society for Information Science*, 50(9), 799–813.
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6. Cronin, B. (2001). Bibliometrics and beyond: Some thoughts on web-based citation analysis. *Journal of Information Science*, 27(1), 1–7.

Appendix B. Survey Items Used (appearance of scale differed in the Web version).

This research will help us understand citation practices in your research specialty and thus contribute to the scholarly literature of scientometrics. If you chose to participate, your participation will be completely voluntary. You may chose to terminate the survey at any point or to skip questions you would not like to answer. There is no penalty for not participating in the survey.

Before you complete this survey you may want to review a copy of the article we identified (in the email that contained the link to this page), and read the few sentences surrounding your citation to the article identified below. Then please answer the following questions, all of which refer to this reference in the context in which you cited it. Use the following five point Likert scale to indicate the extent of your agreement or disagreement with each item.

For items about authors, please indicate your agreement if the item is true of any of the coauthors of the article.

These questions refer to the following article that you cited:

[A citation one of the target, highly cited items appeared here.]

	Strongly Disagree				Strongly Agree
1. This reference is one of the earliest works in the field.	1	2	3	4	5
2. This reference bridges a gap between two subfields.	1	2	3	4	5
3. This is a classic reference in the field.	1	2	3	4	5
4. This reference concerns a currently "hot" topic.	1	2	3	4	5
5. This reference was a major source of the idea for your article.	1	2	3	4	5
6. This reference strongly influenced your thinking on the topic of your article.	1	2	3	4	5
7. This reference documents the source of a method or design feature used in your study.	1	2	3	4	5
8. This reference is authored by a recognized authority in the field.	1	2	3	4	5
9. This reference reports what you consider to be an exceptionally high quality piece of science.	1	2	3	4	5
10. This reference is a "concept marker"—it represents a genre of studies, or a particular concept in the field.	1	2	3	4	5
11. This reference illustrates possible avenues for future research.	1	2	3	4	5
12. This reference reviews prior work in this area.	1	2	3	4	5
13. This reference has withstood many efforts to show that it was wrong.	1	2	3	4	5
14. This reference solves an important conceptual or practical problem in the field.	1	2	3	4	5
15. This reference has generated much novel and successful research or scholarship.	1	2	3	4	5
16. This reference helps to reconcile contrasting viewpoints or findings in the field.	1	2	3	4	5
17. This reference is now theoretically outmoded.	1	2	3	4	5
18. More so than most, this reference advances our ability to address an important social or human problem.	1	2	3	4	5
19. This reference has deficiencies that contrast to the strengths of your article.	1	2	3	4	5
20. This reference illustrates a perspective or finding that contradicts a perspective or finding in your article.	1	2	3	4	5
21. This reference has been subject to many cogent criticisms.	1	2	3	4	5
22. This study used a method or a theoretical perspective that is currently unusual or especially innovative.	1	2	3	4	5
23. This reference is a reiteration of a position formulated many years before this reference was published.	1	2	3	4	5
24. This reference is now methodologically outmoded.	1	2	3	4	5
25. This reference reports an article this is similar to your own article.	1	2	3	4	5
26. This reference was published in a prestigious journal or handbook in the field.	1	2	3	4	5
27. This reference shows the reader that you are familiar with the important literature in this field.	1	2	3	4	5
28. This reference presents an orientation that is congruent with that of the readers or reviewers for the journal in which your article appeared.	1	2	3	4	5
29. This reference reported unique or anomalous findings.	1	2	3	4	5
30. This study used a method or a theoretical perspective that you think is currently unusual or especially innovative.	1	2	3	4	5
31. This reference helps establish the legitimacy of the topic of your article.	1	2	3	4	5
32. This reference was authored by someone who might have been influential in the review process.	1	2	3	4	5
33. Was there another reason or factor, not listed above, that led you to cite the article? Please describe that reason.					
34. Have you ever spoken directly or by phone with the author of this citation?	Yes				No
35. Would you consider the author a personal friend?	Yes				No
36. Is the author a colleague at your institution?	Yes				No
37. Did the author work at an institution where you were trained?	Yes				No
38. Have you ever coauthored a document with this author?	Yes				No
39. Have you read this reference?	Yes				No
40. Did this reference appear in the journal in which your article appeared?	Yes				No
41. Did a journal referee/reviewer ask you to include this particular reference during the review process?	Yes				No
42. Do you subscribe to the journal in which this reference appeared?	Yes				No
43. Do you currently possess a copy of this reference?	Yes				No

Of ALL these 43 items, which one do you consider to be the single most important factor in your decision to cite this particular reference? Choose the number of that item in the box below.

44. To which of the following disciplines, fields or research areas would you say that you belong (please check ALL that apply to you):
- Bibliometrics Scientometrics Informetrics/Webometrics Information Science Librarianship
- Computer Science Physical Sciences Biological Sciences Health/Medical Sciences
- Social/Behavioral Sciences Humanities OTHER Discipline or Profession not named above