

Examining the Evolution of the Field of Public Administration through a Bibliometric Analysis of *Public Administration Review*

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Biography

Chaoqun Ni is an Assistant Professor at the School of Library and Information Science at Simmons College. She studies scholarly communication in the scientific workforce to provide implications for decision-making on resource allocation. Her publications have appeared in journals and conferences of multiple areas: Library and Information Science, Computer Science, Science Policy, Scientometrics, and Bibliometrics.

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Alice Robbin is an Associate Professor in the School of Informatics and Computing at Indiana University Bloomington. Her current research examines failures of interorganizational networks, information and communication technology innovation in complex organizations, and digital divide and social inclusion.

Abstract

In 2015, PAR celebrated its 75th year of publication. For this milestone, the PAR Editorial Board selected 75 most influential articles in the history of the journal. Scholars were also invited to “revisit a selection of these articles” in order “to take stock of what these articles meant for the field.” Bibliometrics offers a complementary visit to the history of a discipline and the evolution of its past research and practice agendas through an analysis of its published literature. This article examines the changes over time in PAR from 1940 through 2013 in authorship: contributions, impact, gender composition, institutional and national affiliation, profession as scholar or practitioner, collaboration networks, and the status of the 75 influential articles. As a story told through an extensive quantitative analysis of scholarly production, perhaps its most important contribution is demonstrating PAR’s centrality to the discipline of public administration and its bridging role between public administration and political science.

Introduction

It is not uncommon for emergent or interdisciplinary fields to seek signals to establish their identity (Adams et al., 2014). The field of public administration is no stranger to this search for identity, having a robust literature with the objective to depict a common disciplinary narrative (see e.g., Wright 2011; Meier 2015; Houston and Delevan 1990; Lan and Anders 2000; Zalmanovitch 2014; Miller and Jaja 2005; Riccucci 2010). One common marker of the development of a discipline or a field is a journal, which signals the cohesion of authors and topics around a novel area of inquiry (Sugimoto and Weingart 2015). By examining the evolution of key journals in the field, we can begin to weave a disciplinary history.

In this instance, we employ scientometric methods to examine the trajectory of the field of public administration through an analysis of articles published in *Public Administration Review* (PAR) from its inception in 1940 through 2013. *PAR* is particularly well-suited for this analysis given its historical importance as one of the oldest of the 47 public administration journals indexed in the Web of Science and quality. *PAR*, which celebrated 75 years of publication in 2015 (Perry 2015) has been continuously highly ranked, from the perspective of both prestige and citation rankings (Colson 1990; Forester and Watson 1994; Van de Walle and van Delft 2014).

Scientometrics provides a particularly useful lens for exploring the history of the field through the pages of *PAR*. Scientometrics is an area of research that studies scholarly information through a quantitative lens, often relying on bibliographic information from published research. Bibliometrics is a set of methods used within scientometrics that focuses on this bibliographic

information. While scientometrics is often associated with the evaluative components (e.g., the construction and use of various bibliometric indicators such as the Journal Impact Factor or the h-index), there is also an arm of scientometrics devoted to understanding the structural dimensions of science. By taking a scientometric approach to studying a discipline, changes over time can be discerned in terms of those who practice in the discipline, the relationship among various fields, and the topics that have been studied. The value of scientometric methods is that they are relatively neutral: they provide lists of topics and authors without any bias. The limitation, however, is that scientometrics provides the *what*, but not the *why*. This is left to experts in the field who can examine the results of bibliometric analyses and provide interpretation.

What follows, therefore, is a story of the producers of the published articles of *PAR*, the editors who act as gatekeepers, the relationship between *PAR* and other fields, and the topics that have shaped the journal. As an historical analysis of a journal, we examined the changes over time in authorship: contributions, impact, gender composition, institutional and national affiliation, profession as scholar or practitioner, and collaboration networks. A journal's editorial board shapes, if not determines, the direction of its contents; we focus on changes since inception in its gender and institutional affiliation composition. Citation analysis can provide an indication of the disciplines that inform research in public administration and those that draw upon research in public administration. The evolution of topics and specific terms employed in the published articles create a defining profile of how the field of public administrative has evolved. Lastly, we compare the results of this bibliometric analysis with the results of the selection of 75 influential

articles by *PAR* board members to determine the extent to which the bibliometric analysis and their selection correspond.

This historical analysis shows that a very large array of issues has been addressed over the 73-year period. This literature has reflected the salience of specific historical events such as World War II and social, economic and technological changes, as well as the evolution of the administrative state, new agendas for action, and calls for improvements in governance. But what is most apparent in the traces that history leaves is the enduring commitment of both the journal's editors and contributors to a science of public administration as reflected in theory, method, and evidence and to the experiences of both practitioner and scholar.

Methods

To describe the contribution and evolution of *PAR* since its inception, we undertook a comprehensive bibliometric analysis of articles published in *PAR* examining authorship characteristics (e.g., productivity, gender, affiliation, and collaboration); characteristics of editorial board members (gender and affiliation); interdisciplinary connections and context of *PAR*; and the topical orientation of the research, as reflected through title words. In addition, we incorporated and provided additional analyses on a perception-based list of influential articles compiled in 2013 by the *PAR* Editorial Board.

Articles

PAR publications for the time period 1940 through 2013 were downloaded from the Web of Science (WoS). Only publications indexed as "Articles" were included in the bibliometric

analysis.¹ Articles with anonymous author information (n=32) were removed.² In total, 3,934 articles were included in the bibliometric analysis.

Author and Editorial Board Analysis

There are no unique author identifiers in WoS that link authors to their collective works.

Therefore, the name alone serves as the unique identifier—that is, one can search for a distinct author name and retrieve all articles authored by someone of that same name. This approach works fairly well for small-scale studies, although it is still prone to issues of collapsing names that are distinct individuals (homonyms in the bibliometric parlance) and separating counts of an individual due to name changes, or the presence or absence of a middle initial (synonyms). Data cleaning on the entire sample is not feasible; therefore, data cleaning was restricted to the top twenty authors over time and the top five authors by decade to identify and correct mistakes. For example, MOYNIHAN-DP was a collapse of publication counts for Daniel P. and Donald P. Moynihan, which was corrected. Separate entities for a single individual were also found (e.g., WISE, CR and WISE, C both referred to Charles R. Wise). Also corrected were obvious misspellings (e.g., COGBURN, JD and COGGBURN, JD) and inverted initials (e.g., HOLT, BJ and HOLT, JB) after checking the original articles for clarification.

Gender of authors was determined by the use of the automatic gender algorithm developed in Larivière et al. (2013) which uses a validated list of names and probabilities for the occurrence of the name with a particular gender. This algorithm requires the use of full names, which are only available in WoS since 2008; gender analysis for authors is thus limited to 2008 through 2013. Editorial board members were gathered manually, so full names were available for the entire time period of 1940 through 2013. These names were also processed with the name-gender

algorithm. Additional manual validation and web searching were conducted on this set to reduce missing data.

The affiliation was also gathered for all the authors and editorial board members. Of the 3,934 articles analyzed here, 2,908 (73.9%) have one or more institutions indexed by WoS. A large number of publications in WoS lack affiliation information. A majority of those articles without affiliation information indexed by WoS were those published in earlier time periods: in the 1940s, only 0.4% articles have identified author affiliation, while the number increased to 97.8% in the 2010s. Because these are standardized and machine-readable data, these were used for the large-scale data on affiliations. No manual coding was done to identify missing affiliation data. All affiliation data for editorial board members were gathered manually.

Articles were coded into four categories based on author affiliation: 1) academic, 2) non-profit or for-profit, 3) government, and 4) mixed. For the manual coding of the type of affiliation, individual articles were coded and web searching was conducted to identify missing information. In total, fewer than 5% of the data were missing and were distributed evenly across sectors. Coding was done at the article level rather than the author level; that is, an article was coded as “academic” if all authors on the paper were academic. An article was mixed if it had authors with multiple affiliation types. Collaboration was operationalized as the presence of more than one author on the byline of an article. Although there are many forms of collaboration that do not manifest themselves in a co-authored publication, co-authorship has been confirmed as a reliable proxy for scientific collaboration (Franceschet and Costantini 2010).

Citation Analysis

Citation analysis is the most widely used method in scientometrics. The method is frequently linked to evaluative purposes (e.g., Journal Impact Factor, university rankings, and citation

counts as proxies for the quality of a paper), but can also be used to provide descriptive accounts of the structure of science. References placed by an author in a given article link that article to earlier literature. Subsequent works citing the given article connect this work to the future. Analysis of all the references within a corpus can improve an understanding of the foundations of that field: what works does this field draw on? Analysis of all the citations to a given field also answers the parallel question: what areas of research does this field contribute to? In addition to analyzing the exchange of citations between fields, citation analysis can also be used to understand the similarities between fields. Co-citation analysis uses the citation patterns among sets of documents to construct “invisible colleges”—that is, to identify groups of similar scholarship (Small 1973). At the document level, co-citation analysis examines the degree to which two documents are cited by the same document. The more two documents are cited together by other documents, the greater the similarity. This can be aggregated to any level—including author (White and Griffith 1981), journal (McCain 1991), and field (Sugimoto, Pratt and Hauser 2008). Network analysis provides a mean for calculating indicators for these similarities and displaying them visually.³

Three types of citation analyses were performed on the data: 1) analysis of importers (those journals that cited *PAR*); 2) analysis of exporters (those journals referenced in *PAR* articles); and 3) co-citation analysis (those journals with which *PAR* is referenced)⁴ for the fields of Public Administration and Political Science. To do this, journals had to be grouped according to field. We used the matching between the National Science Foundation (NSF) and Web of Science (WoS) disciplinary classification schemes developed by the Observatoire des Sciences et des Technologies at the Université du Québec à Montréal. The disciplinary classification of NSF instead of WoS was adopted based on the consideration that: (1) the NSF classification has a

hierarchical structure of two levels (discipline and specialty) which allows analysis at different levels of aggregation; and (2) the NSF classifies each journal into one discipline and area, which prevents double counting of publications for disciplines. The limitation of this approach is that the NSF classification merges Public Administration and Political Science into a single category, diluting the nuances between these areas. As such, given the focus of this study, a second analysis was compiled that focused only on those journals classed in either (or both) Public Administration or Political Science according to WoS.

Word Analysis

Title words were used to illuminate the topical structure of *PAR* in 25-year increments. In addition to general stop words, words and phrases such as “public,” “administration,” “public administration,” “government,” and “management” were removed and minimal stemming⁵ was applied. In addition, titles were mined for the most frequently occurring words by time period. There is, of course, artificiality to the selection of these time periods: they were selected in order to generate a large enough sample for the first time period and to represent periods that were long enough to observe topical shifts. However, one could easily have selected another unit of time to display these. This is an acknowledged limitation of the methods.

Influential Articles Selected by the PAR Editorial Board

In March 2013, Editor-in-Chief James Perry wrote members of the *PAR* editorial board requesting that they collectively identify the 75 most influential articles in the journal as a way to celebrate the journal’s 75th anniversary.⁶ Fifteen three-person teams were created and each team was instructed to select the most influential articles published during a five-year period between 1940 and 2013 (e.g., 1940-1945, 1946-1950, 1951-1955). The teams were provided with a data file containing 625 articles based on six influence indicators: average number of citations per

year as calculated by Web of Science (WoS), number of citations (WoS), number of citations according to GoogleScholar, JSTOR downloads, *PAR* awards, and reprints. Teams submitted between two and ten articles for each time period, from which the Editor-in-Chief made the selections that constitute the 75 most influential articles (referred to here as the “75 Influentials”). We provide these articles in the supplementing information and conduct an analysis of the citation profile of these articles. However, it should be noted that the respondents were provided with the number of citations during their selection process, so this may have influenced their selection. Correlation between selection and citation, therefore, should be interpreted cautiously.

Results

Our results examine the characteristics of authors and editors within *PAR*, interdisciplinarity of *PAR* articles, and topical orientation of the articles. In addition, we provide a citation analysis of those articles identified as influential by the *PAR* Editorial Board.

Authors and Editorial Board Members Analysis

3,997 individual authors contributed to 3,934 indexed *PAR* articles since 1940. The typical long tail phenomenon of scientific publishing is present in *PAR*: 36 of the 3,997 authors contributed ten or more articles to *PAR* and 2,561 (64.1%) authors published once in *PAR*. Table 1 provides a list of all authors contributing more than 12 publications (top 19 authors).⁷ Editorial board members are significant high-frequency contributors of *PAR*: of these top 19 authors, 15 (78.9%) were or are members of the *PAR* editorial board (indicated by an (E) in the table). Asterisks

denote authors associated with one of the “75 Influentials” identified by the *PAR* Editorial Board in 2013.

[Table 1 here]

Many of these authors were highly productive within a single decade, while others were dominant across multiple decades. Table S1 (see supplementing information) presents the top five most prolific authors per decade from the 1940s through 2010-2013, with the number of articles published in that decade. As shown, seven authors achieved dominant status in more than one time period: Shore, Lyden, Golembiewski, Levine, Ingraham, Moynihan, and Feiock. All of these authors occur in sequential decades, with the exception of Golembiewski who appears in the top five most productive in the 1960s and then again in the 1990s. Highlighted individuals are high-frequency authors across more than one decade. Many of these authors are also highly published across public administration journals. All but seven of these authors appear in a list of the top 100 most productive scholars across 23 public administration journals, compiled in 2010 (Corley and Sabharwal 2010).

Some of these most prolific authors were also active researchers over some decades. For example, Golembiewski published articles in every decade between the 1950s and 1990s (Total N=16). Perry has published continuously over five decades, between the 1970s and 2010s (N=19). Although not necessarily dominant within one decade or across decades, other scholars

were also productive over several decades. For example, Frederick Mosher published from the 1950s through the 1980s (N=10). Luther Gulick, Norton Long, and Ferrel Heady published articles over six decades beginning in the 1940s (Total N=8, N=9, N=10, respectively). H. George Frederickson, Robert Denhardt, and Frederick Riggs have each been active over six decades, between the 1960s through the 2000-2009 decade (N=10, N=8, N=7, respectively).

PAR authors were associated with 362 organizations, including universities, companies, and governmental agencies. Table 2 identifies the most productive of these organizations (all those representing more than 1% of total articles), measured by articles with which they are associated, and the number of authors associated with these articles.

[Table 2 here]

The top institution by productivity is also tracked by decade. Table S2 (see supplementing information) identifies the number of articles associated with each institution by decade: the top five contributing institutions are displayed for the decades between 1960 and 2013, ties included for the decade of the 1960s.⁸ The number in the parenthesis next to each institution indicates the number of articles associated with that institution. In the top row, the number in parentheses is the total number of articles with institution information available in WoS by decade. Syracuse University and Indiana University rank among the highest frequency institutional affiliations in every decade since the 1960s. These institutions correspond fairly well to historical rankings of

programs by productivity across public administration journals (Douglas 1996; Forrester 1996); however, the rankings of these institutions do not correspond to rankings when all public administration journals are taken into account (see Table 3 in Wan de Walle and van Delft 2014).

PAR editorial board members were associated with 437 unique institutions. The top five institutions, in ranked order by number of editors associated were: 1) Indiana University Bloomington, 2) University of Southern California, 3) Syracuse University, 4) Florida State University, and 5) University of Georgia. These correspond to highly ranked programs in public administration (Douglas 1996; Forrester 1996).

During this time period, the United States is a major contributor to *PAR*—associated with more than 70% of *PAR* articles. However, a number of other countries also appear on the byline of articles, and the proportion of authors from non-US institutions has increased over time since, for example, the 1970s, when non-US institutions accounted for 2.3% of authors to more recently in the 2010s to 20.5%.⁹ In total, *PAR* authors are affiliated with 30 different countries/territories. The most frequent contributors, after the United States, include England, China, Canada, the Netherlands, and South Korea (in that order).¹⁰

As can be inferred from the list of highest contributing affiliations, *PAR* authors are largely from academic settings; however, this has not always been the case. In the 1940s, more than half the articles were written by authors from the governmental sector. In the current decade, there were no records in our sample written solely by government authors. Instead, there has been a steep

increase in academic authors, with more than 94% of authors in the last few years from this sector (see Figure 1). (See Supplementing Information for Figure S1 color reproduction.)

[Figure 1 here]

There are, however, a small number of papers written in each decade with mixed affiliations: either the result of a single-authored work where the author has a dual appointment across more than one sector or a joint-authored paper where authors represent different sectors. Such coproduced articles have been heavily promoted for their potential to bridge the practitioner-academic divide, although they have also been noted for their complexities (Orr and Bennett 2012). The most common authorship coupling is academic and government, representing nearly two-thirds of all mixed authorships. The academic and profit or non-profit sector represents slightly less than a third of the mixed contributions. Between 1940 and 2013, only eleven articles with mixed authorships were identified without an academic author.

Single-authorship is the norm in *PAR*: more than two-thirds of all *PAR* articles have only a single author (n=2,715, 68%). The 5,576 authorships, that is, instances of an author on the byline of an article, are associated with the 3,934 unique *PAR* articles, resulting in an average of 1.42 authors per paper. Of all *PAR* authors, only 2,002 have ever collaborated with each other once or more between 1940 and 2013 (on a *PAR* article). There are 193 authors who have collaborated with each other two or more times. Less than one-percent of articles in *PAR* have five or more

authors. This collaboration rate of 31% is lower than all articles from journals indexed in the Web of Science in the same time period (1940-2013), which is about 75%. It falls in-between the rates for all journals in the WoS Subject Category for Public Administration (39.4%) and Political Science (22.4%). It is precisely in line for the collaboration rate of journals jointly classed in PA and PS (31.8%). However, collaboration rates are increasing: the collaboration rate of *PAR* was about 10% in the 1940s, and has increased to about 54% in the 2010s (see Figure S1). This is slightly lower than contemporary collaboration rates across Public Administration journals (Adams et al. 2014; Henriksen 2016), but higher than many other social sciences (e.g., the proportion of collaboratively authored works in political science was around 35% in 2013; Henriksen 2016).

Given this relatively low collaboration rate, the collaboration network for *PAR* is fairly sparse and contains few dyads. Only 193 authors collaborated with each other two or more times. Collaborative authors who have published five or six *PAR* articles together include Kenneth Meier and Laurence O'Toole, George Boyne and Richard Walker, Evan Berman and Jonathan West, William (Bill) Simonson and Mark Robbins, F. Glenn Abney and Thomas Lauth, and Kenneth Kraemer and John King. What distinguishes these scholars is that they have also been significant collaborators with each other in other publication venues and have also collaborated extensively with other scholars. For example, those with whom Kraemer has collaborated in *PAR* articles, in addition to King, include Alana Northrop, James Perry, and James Danziger. In addition to Meier, O'Toole has collaborated with Charles Wise; Boyne with Rhys Andrews. Meier, O'Toole, and Kraemer rank among the *PAR* authors contributing the highest number of articles (see Table 1).

There has been historical concern about the dearth of women in leadership roles in public administration (United Nations Development Programme 2014). We analyzed the degree to which gender equality had been met in *PAR* according to the authors and editorial board members. Authorship data was available from 2008-2013. During this time, 455 articles associated with 768 authorships were published: 167 (21.7%) female authorships and 601 (78.3%) male authorships.¹¹ Female authorship has remained at between 20% and 25% of authorships for the period studied. This rate is lower than the global average across all scientific fields during this time (Lariviere et al. 2013) and lower than reported rates of female faculty in public administration (Sabharwal 2013).¹²

Since the inception of *PAR*, 690 unique individuals have served in some capacity on the editorial board of *PAR* (either as editorial board member or editor-in-chief). Of these, 510 were classed as male and 174 as female (6 could not be classed due to missing first names). The gender composition of the editorial board has changed over time, as shown in Figure 2. Note that some editorial board members might have served across decades. For example, Dwight Waldo served on the editorial board for 18 years as editor-in-chief and editorial board member. In such cases, an editorial board member was counted in each time period of service.

[Figure 2 here]

As shown, editorial board composition has been gradually moving towards gender equity in recent decades (and is more gender balanced in recent years than *PAR* authorship), although it still falls below the representation of female faculty in public administration (i.e., 40%) (Sabharwal 2013).

Citation Analysis

PAR articles have been cited by both articles published in *PAR* and other journals. As of March 2014, *PAR* articles had received 27,574 citations (from WoS-indexed source items), of which 5,760 (20.9%) were self-citations.¹³ The rate for 2010 is 15.4%, similar to the rate of self-citations for *Journal of Public Administration Research and Theory* (at about 14% for the 2010s) and lower than demonstrated in larger cross-disciplinary analyses (e.g., Aksnes 2003), suggesting that *PAR* does not cite itself more than would be expected.

Articles, specialties, and disciplines that cited *PAR* articles were analyzed to measure the impact of *PAR* on other journals. Self-citations were removed for this analysis. *PAR* articles have been cited by articles in 1,871 journals from 104 disciplines of 14 National Science Foundation category areas. The number of disciplines that have imported knowledge from *PAR* in the form of citations has increased diachronically and most markedly in the 2000s. There is a core set of disciplines that cite *PAR* articles more than others. Two specialties (Political Science & Public Administration, and Management) contributed more than 61.8% of *PAR*'s citations. More than 99% of *PAR*'s citations came from 22 disciplines, which are considered as the core set of citing disciplines in this analysis. Figure 3 displays these 22 disciplines and the proportion of citations that they contributed to *PAR*, across three large time periods. The decline in the proportional contribution of Education, Economics, and International Relations and the rise of Law can be

seen as well as the increasing diversity of the citing disciplines of *PAR*. These results are somewhat in conflict to Wright's (2011) assertion that *PAR* is ignored by the law, management, and political science journals (see also Andrews and Esteve 2015 for their analysis of the low rate of citation by management journals).

[Figure 3 here]

The National Science Foundation considers "Political Science & Public Administration" as a single discipline. Journals in Political Science & Public Administration contributed about half of *PAR*'s citations, making it the largest importer of *PAR*. However, since Political Science (PS) and Public Administration (PA) are separate disciplines according to the Web of Science schema, we can also dive into this category for further analysis.

The 2013 edition of the *Journal Citation Report* (JCR) reports 46 journals in the Public Administration (PA) category, and 156 journals in Political Science (PS) category.¹⁴ As mentioned above, journals can be classified into multiple categories by JCR. In this analysis, 11 journals appear in both the PA and PS categories according to the WoS schema.¹⁵ *PAR* is categorized as a PA journal.

As of April 2014, 130 PA and PS journals had cited *PAR* articles, contributing 10,946 citations to *PAR* and accounting for 51.2% of total non-self-citations. The percentage of articles in the

Public Administration category citing *PAR* has increased over time with a corresponding decrease in citations from Political Science.

Twenty PA and PS journals account for about 40.8% of citations received by *PAR* (see Appendix A). The largest citing source of *PAR* in the category of Political Science is *Publius: The Journal of Federalism*, followed by the *American Political Science Review* and *Journal of Politics*. In the category of Public Administration, *Administration & Society*, *Journal of Public Administration Research*, and the *American Review of Public Administration* are the major importers from *PAR*. High citing cross-listed journals include *Public Administration* and *Policy Studies Journal*.

To examine the disciplines and journals from which *PAR* imports knowledge we analyzed the references in *PAR* articles. As of April 2014, *PAR* articles had referenced 1,123 journals (not including self-citations) indexed in the Web of Science. These journals are classified into 105 disciplines according to the National Science Foundation schema. Since an article can be cited more than once, this reference set includes 9,089 unique articles. As with citing disciplines, the number of disciplines from which *PAR* draws knowledge has increased over time.

PAR draws on some disciplines consistently. Figure 4 displays the top 20 disciplines by the number of times it was cited by *PAR*. These disciplines account for nearly 95% of all indexed *PAR* references. Reinforcing the observations of Adams et al. (2016), we find an increasing reliance on the area of public administration over time. However, there remains a strong connection to management, economics, and sociology.

[Figure 4 here]

As with the citing data, the reference set of *PAR* can also be differentiated between Public Administration (PA) and Political Science (PS) by employing the Web of Science schema. Overall, *PAR* cited journals in PA and PS categories 4,614 times, including 1,877 times in 23 PA journals, 2,313 times in 70 PS journals, and 424 times in six co-classified journals. The percentage of Public Administration references has increased, although *PAR* continues to draw the plurality of references from Political Science (although it should be noted that there are more journals categorized as Political Science and therefore a higher probability of referencing this domain) (see Figure S2). This connection to Political Science is stronger for *PAR* than for other similar PA journals (see, e.g., analysis of JPAM and PSJ in Adams et al. 2014) and is in direct contrast to Wright's (2011) assertion that the rate at which *PAR* incorporates knowledge from political science is low.

Appendix B displays the 20 journals that are referenced most frequently in *PAR* articles. In the Political Science Category, *PAR* draws most from the *American Political Science Review* and the *American Journal of Political Science*. From Public Administration, *PAR* imports from *Administration & Society* and *Journal of Public Administration Research and Theory*.

PAR has been co-cited—that is, has appeared in the reference list—with articles from 182 journals in PA, PS, and PA&PS. As such, the co-citation network of PA and PS journals in this analysis has 183 nodes (each representing a journal), which creates 8,279 ties. The construction of co-citation networks allows for the calculation of centrality measures. Degree centrality

provides the number of ties a node has to other nodes in the network. Nodes that have more ties may have multiple paths to reach goals and are thus relatively advantaged. Closeness centrality measures the degree to which a node is near all other nodes in a network. Betweenness centrality is a measure of the extent to which a node is connected to other nodes that are not connected to each other. It provides an indicator of the degree to which a node serves as a bridge.

The co-citation relationship between *PAR* and other journals in PS and PA is analyzed by 25-year time windows (Figure S3-S5). During 1940-1964 (Figure S3), there were 14 journals in the co-citation network. Thirteen journals are in the category of Political Science, and *Public Administration* is the only journal in both PA and PS. As displayed in Figure S3, *PAR* was co-cited with another seven journals. The journal most co-cited with *PAR* is the *American Political Science Review*. During the 1965-1989 time period (Figure S4), there were 63 journals co-cited with *PAR*. Most frequently co-cited with *PAR* are the *American Political Science Review*, the *Journal of Politics, Administration & Society*, *Policy Sciences*, and *Social Science Quarterly*. During the 1990-2013 time period (Figure S5), the top five co-cited journals are the *American Political Science Review*, *Administration & Society*, the *American Journal of Political Science*, *Public Administration*, and the *Journal of Politics*.

Table 3 displays centrality measurements across time, showing the increasing importance of *PAR*, based on these indicators. As indicated, *PAR* has the widest connection with other journals in the field during the 1965-1989 time period according to its degree centrality: it ranked top 2 out of 70 journals. According to the closeness centrality, *PAR* also reached its highest closeness centrality in the 1965-1989 time period, indicating its close relationship with other journals in the field. *PAR* also shows its most important role in the field during the 1965-1989 time period: it ranks in the top 5 out of 70 journals in terms of betweenness centrality, which can be considered

as a measure for quantifying the control of *PAR* on the communication between other journals in the field.

[Table 3 here]

Word Analysis

We extracted from among the top 50 most frequently occurring title words those that appeared in all three time periods. Thirteen words comprised the “core” set—that is, words that appeared in the top 50 most frequent title words across all three time periods. This removed any word that appeared among the most frequent in one time period, but not in the other two. The goal of this is to show not what was popular within a time period, but the stable core of topics that remained popular across time. In total, the following thirteen words represented the core words for *PAR*: *federal, state, service, budget, program, local, policy, new, bureaucracy, system, civil, role, and city*.

Among the group of top 50 title words by time period, we also analyzed those that were unique to each time period (the full list can be found in Appendix C). These suggested the topical distinctions for each time period. Articles written during the 1940-1964 period were devoted to the role and responsibilities and normative (democratic) of federalism and the federal administration during and following World War II. Federal-state, federal-local, and state-local relations and coordination and administrative aspects of legislative and executive relationships;

and public policy received attention. Throughout this entire period, but especially during the 1940s into the 1950s, recovery, innovation, and reform of the civil service were important concerns, with efforts to theorize and create a science of public administration. Articles on the federal government included discussions about (re)organization and administration; administrative practices and the training of public personnel; and comparisons between the role of the career civil servant in the U.S. and Western European countries, government administration, and public policy. Authors gave attention to the federal government budget process, including both the theoretical and practical issues concerning reform, planning, personnel, and administration, with some attention to similar issues that faced city government. Late in this period showed evidence of concerns about the technological infrastructure and the role of administrative and electronic data processing systems.

During the 1965-1989 period increasing attention was given to politics, decision making, public policy and program analysis, research, and utilization. Theories of public choice and political economy began to dominate discussions. The federal budget and budget reform continued as concerns, along with new methodologies for program planning, management, and implementation. Discussions about challenges to federalism, about state and local relations, and about the theory and practice of the administrative state, including civil service modernization, were unabated. The language of “systems” entered the vernacular, and more attention is given to information technology and computerization in public administration.

A long list of concerns registered in the 1990-2013 period. These included reform (“reinvention”) and innovation, policy, planning, service delivery, program management, performance, implementation, monitoring and evaluation, and accountability within federal- and

state-level governments. Concerns were registered, as they had been since the beginning of *PAR*, about the quality of personnel in the federal civil service. The effects of privatization on public organizations received increased attention as private organizations took on formerly public sector responsibilities. Discussions continued about the challenges of federal-state relations. New Public Management, what constitutes public administration, what constitutes a representative bureaucracy, and public participation dominate discussions of governance. Theoretical, methodological, and empirical concerns about the discipline increase. The language of Interorganizational networks assumes prominence beginning in the late 1990s. Information technology and infrastructure in public administration evolve into concerns about e-government (and e-governance) with increasing attention to e(citizen)-participation.

Influential Articles

The top 10 cited articles of *PAR* across all time periods overlap with the 75 influential article list (see Table S3). Of the top 20 highly cited articles, only two of them are not in the list of influential articles (Korten 1980; Ho 2002). Data show that influential articles outperform non-influential articles published in the same year in terms of citation, except one article which underperforms (Altshuler 1965). The average difference in terms of citation between the influential article and non-influential article published in the same year is 110.4. The number of citations received by influential articles is significantly higher than those by non-influential articles ($p < 0.000001$). This suggests that the highly significant p-value may be a function of the methodology employed for selection of the “Influentials.”

Discussion

This work revealed several key characteristics of *PAR* authors and editorial board members. The authors, and their associated affiliations, are reflective of the most productive authors and highly ranked affiliations across the range of public administration journals (Corley and Sabharwal 2010; Douglas 1996; Forrester 1996). This reinforces the role of *PAR* as a core journal in the field. Furthermore, there is a comparatively high degree of stability among the publishing core: that is, those authors with more than one publication in *PAR*. The percent of authors with a single publication in *PAR* (64%) is lower than average for most fields: the average across fields is 69% of authors contributing a single publication (Ruiz-Castillo, and Costas, 2014). The number of authors who are highly productive across multiple decades suggests a permanence to the core. However, this core is not at the expense of growth or change in the composition of the *PAR* authorship. *PAR* has seen an increase in the international composition of authors over time. In fact, at the time of writing (November, 2016), the majority of 2016 *PAR* authors were not from the United States. This is a dramatic shift from an almost entirely American journal at inception and a marked shift even in the last few years.

A similarly dramatic increase in female authors was not observed. The gender balance in terms of authors is lower than the global average across all scientific fields (Larivière et al. 2013) and lower than the rate of female faculty members in public administration (Sabharwal 2013). This may be partly explained by the lower levels of productivity observed for female faculty in public administration (Sabharwal 2013; Slack et al. 1996). Manuscripts from women are accepted at a higher rate than manuscripts of men (Kellough and Pitts 2005), suggesting that the lower rates are not due to discrimination in review. Furthermore, the *PAR* editorial board has more equity in gender composition than authors and has been consistently trending toward parity. This holds

promise for the authorship contribution; as shown in our analysis, there is a strong relationship between editors and highly productive authors in the journal. Of the most productive authors, nearly 80% were associated with the editorial board at some time. Although the nature and directionality of the relationship is unknown, our data suggest that an approach towards gender equity in the editorial board may be matched with a similar progress in terms of authorship.

Another area of disparity is in the contribution from non-academic authors. The trend away from practitioner contributions has been observed in other similar journals: for example, in an analysis of *Journal of Policy Analysis and Management* (JPAM) and *Policy Studies Journal* (PSJ) (both highly co-cited with *PAR*), the percentage of practitioner authorships had decreased to 5% (JPAM) and 1% (PSJ) in recent years (Adams et al. 2014). The potential disconnect between theory and practice has been a longstanding concern for this and other public administration journals (Newland 2000), with some suggesting a mismatch between practitioner concerns and academic research (Streib, Slotkin, and Rivera 2001) and providing several explanations for the decline in contributions from practitioners (Raadschelders and Lee 2011). The complexity of this issue often revolves around the utility of research (Gow and Wilson 2014), regardless of the affiliation of the authors. To address this, the current Editor in Chief of *PAR* has explicitly encouraged authors to generate more “usable knowledge” for professionals (Perry 2012) and to urge co-authorship (Perry 2017).¹⁶

Bozeman (2012) has called for more scientometric studies of public administration research, examining, specifically, the relationship between public administration research and other disciplines. Our work examines the citation context of *PAR* from several dimensions. *PAR*’s self-citation rate has decreased over time and matches other highly ranked journals in the field (e.g., *Journal of Public Administration Research and Theory*). *PAR* is also cited by a diverse array of

disciplines. In the most recent years, *PAR* has received the majority of citations from public administration journals, but has also received a sizeable proportion from political science and management. The proportion of citations from management, however, is lower than in previous years, largely because of a rise in citations coming from law journals. *PAR* draws heavily from political science, management, economics, and sociology. The portfolio of referenced disciplines has been relatively stable, proportionally, between the 1965-1989 time period and the 1990-2013 time period, suggesting some saturation in the interdisciplinary influences on the field.

The relationship between the research of political science and public administration is a longstanding and contested one (Whicker, Strickland, and Olshfski 1993; Guy 2003; Demir 2009; Georgiou 2014). We provide here a new lens of evaluating this by mapping public administration and political science by means of co-citation analysis. As demonstrated through co-citations, *PAR* is more frequently co-cited with Political Science journals than other Public Administration journals, but is also highly co-cited within the Public Administration literature. The high (and increasing) betweenness centrality provides empirical evidence of the bridging role that *PAR* plays between Public Administration and Political Science research. However, the network visualizations also display the growing independence of Public Administration from Political Science. Public Administration journals appeared as peripheral nodes loosely connected to the Political Science literature in early years, but have begun to demonstrate more within field cohesion in recent times. This is reinforced by the decreasing use of PS references in PA research, in favor of citing Public Administration research. The trend suggests that public administration will continue to solidify as a community and that *PAR*'s role as a bridge between public administration and political science may become increasingly more pronounced over time.

Several analyses have been carried out to investigate the content of *PAR* journal articles from various perspectives (e.g., Gooden 2015; Groeneveld et al. 2015; Perry and Kraemer 1986; Jones and Doss 1977). Our work contributed to this by analyzing title words—a validated measure for examining the cognitive structure of a corpus (Milojevic, Sugimoto, Yan, and Ding, 2011)—over the lifetime of the journal. As might be expected, selection of the “Influentials” captured only some of the dominant concerns by *PAR* scholars and practitioners. Although the influentials of the 1940-1964 period certainly reflected concerns about programs, federalism, and the role of the public administrator, the influential articles selected by the *PAR* teams appear to more strongly represent concerns about public administration as a science and, thus, the need for a theory of public administration and the role of the public administrator in a democratic society, and the need for reform of the civil service system. Influential articles during the 1965-1989 period more closely reflect the increasing attention given to politics, public policy, and reform, but with a much more theoretical bent; public choice enters the vernacular along with its potential consequences for public administration and the society. The results of our analysis of *PAR* articles during the 1990-2013 period are remarkable for the very large number of substantive issues that public administration scholars discussed.

The articles of the Influentials, however, reflect only a small number of these issues, concentrating on the theoretical, methodological, and empirical and representing the increasing turn from the earliest period represented by the practitioner to the later periods represented by the scholarly community. Perhaps only in the interstices of the production of these influentials rests the enduring concerns about the field and manifestation of the angst about the future of the field, about the future of the public organization, and about the challenges of scholarship and practice

(see, for example, Wise 2010; Dull 2010; Khademian 2010; Raadschelders and Lee 2011; Stillman 2011; Kapucu 2012).

Conclusion

The results of the bibliometric analysis suggest several areas of development for *PAR*, particularly in how *PAR* might broaden the representation of its authors and the relevance of the journal for multiple stakeholders.

If *PAR* is committed to gender equity in authorship, working towards gender equity on the editorial board—and perhaps in the highest editorial position—may be a good first step. The editorial board is moving in this direction: in the most recent years, the board moved from 34% female in 2014 to 41% in 2016—parallel to the rate of female faculty in public administration. Diversity is also increasing in terms of international authors, which, in 2016 reached a majority of *PAR* authors. *PAR* should carefully consider recruiting an editorial board that reflects the composition of the field and encourages a diversity of voices.

PAR serves as a link between the domains of public administration and political science. However, there continues to be asymmetry in the exchange of knowledge between the fields regarding *PAR*: *PAR* receives most of its citations from public administration, but continues to draw the majority of references from political science. It is not atypical for a journal to receive the majority of citations from within the field—this can serve as a sign of maturation for the field. However, if *PAR* seeks to continue to serve as a bridge between political science and public administration, it will need to intentionally position itself to make its work visible and relevant to the political science community.

Collaboration has increased across all units of analysis—author, institution, and country (Gazni, Sugimoto, and Didegah, 2012)—due to both changes in the ways in which science is conducted and also the ways in which those who labor in science are given credit for their work (Larivière et al. 2016). *PAR* is no different: the majority of recent publications in *PAR* are collaboratively authored, at a rate higher than many social sciences. An increasing number of institutions outside English-speaking countries are developing programs whose curriculum is provided in English and are now requiring that their faculty publish in international highly-ranked journals whose publication language is English. And as science becomes increasingly international and international collaboration is encouraged, we can expect that *PAR*'s roster of non-native English authors to increase.

Yet, despite the rise in co-authorship, there is a decrease in collaborative work across sectors (i.e., government, industry, academe). Given the dramatic decline in practitioner research in recent years, *PAR* may want to encourage collaborative work across sectors to produce work that is relevant across multiple stakeholder groups. University degree programs in public administration may also want to consider strategies that “cement” the co-authorship relationship between instructor (scholar) and student during and after graduation, so that collaboration and authorship opportunities are strengthened; this has been a successful strategy in information science, our own field. Further, from one of the authors own experience in public agencies, most scholars do not, or perhaps only briefly, embed themselves in the life world of a government agency; data are obtained, civil servants thanked for their assistance, and scholarly articles then written for publication. Time, resources, and internal support inside an agency are often lacking, thus discouraging potential collaboration and co-authorship. As such, public administration

scholars may want to consider how they can contribute to the government agencies and organizations that they study.

Acting as meta-analysts, bibliometricians whose role is to present results and not to speculate on their meaning, we, instead, turn to you the reader, the experts in the field, to interpret or evaluate these results. As information scientist Birger Hjørland (2016) has noted, “A lack of subject knowledge on the part of meta-scientists may provide problematic interpretation of the empirical patterns observed” (22). It is thus fitting to leave the reader with some of the thoughtful questions posed by the three anonymous reviewers. More generally, their questions address how the results of this bibliometric study inform the profession: One reviewer asked, “How do these results challenge us to think about the history and future of the discipline?” A second reviewer raised an ongoing “problematic” confronting the profession: “Would we be better off discussing the substantive issues facing the field, rather than ringing our hands about methodology and relevance.” The first reviewer went on to ask, specifically, about the implications of this analysis of institutional affiliation for our understanding of public administration research and education, for the status of our knowledge across the globe, for investment in the practitioner, for sharing knowledge, and, more generally, the status of public administration in the management and social sciences.? These grand questions will engage the profession for many years to come, as they have in the many earlier decades since *PAR*’s inception.

Notes

1. As we explain below, this decision led to our analysis of 74 of the 75 “PAR Influentials.” One of the “Influentials” is identified by WoS as a “Note” (Moe, 1994).
2. It should be noted that this excludes categories in WoS such as “Note” —many of these are replies and responses, but others are research notes (e.g., Rainey, Pandey, and

Bozeman 1995). Some of these are indexing errors, while others are nomenclature differences between journals and indexers. However, the average page length of items classed as “Notes” in *PAR* is three pages (compared to an average page length of eight for *PAR* articles), suggesting that most of these are truly non-research articles. Also removed are “Review” articles because this is often used by WoS to describe short reports, reviews of conferences, and other non-empirical work; however, there are several other significant works classed as “Review” in *PAR*, including Van Wart’s (2003) which had garnered more than 70 citations at the time of this writing. These limitations, as well as others associated with using large-scale bibliometric databases, are well-documented in other sources (Cronin and Sugimoto 2015), and acknowledged in the present study. The anonymously authored “Report of Public Policy Issues Committee,” which contains no cited references, is an example of such a report.

3. All networks were visualized with the Kamada–Kawai layout in Pajek.
4. These analyses are restricted to items that are indexed in WoS. Therefore, the citation, reference, and co-citation counts are underestimates and prone to established document type and disciplinary biases of WoS (Cronin and Sugimoto 2015).
5. Stemming is the process of reducing inflected or derived words to their word stem, base, or root form. While there are many stemming methods for processing English words, this articles uses English Minimal Stemming, which changes plural words to their singular forms. English Minimal Stemming is part of Lucene, which is a full-text search library in the Java programming language.

6. James Perry. Communication to *PAR* Board Members on the Subject of *PAR's* 75 Most Influential Articles, 1940-2015, March 11, 2013. See James Perry, Happy 75th, *Public Administration Review* 75(1): 6-7.
7. It should be noted that this does not account for name changes or name variants in the Web of Science database, so this may be a conservative estimate for some authors. However, all the articles associated with the top twenty authors were checked for accuracy, revealing some indexing errors (such as classing Daniel P Moynihan with Donald P Moynihan). These inaccuracies were corrected in Table 1. Also note that these authors are only for the document type "Article." Many of these would be higher were "Review" or "Notes" included in the calculation. For example, Lyden wrote several notes (N=17) and many others authored "Reviews." It may be noted that Shipman, among others, published a number of "Developments in Public Administration" and other less research-oriented papers that were still classed as articles in WoS. These were high frequency publications (e.g., Shipman published six articles between 1963 and 1965), but are not high citation articles (e.g., Shipman's six articles received a total of one citation).
8. Given the sparseness of data in the 1940s and 1950s, only data from the 1960s forward are presented in Table S2.
9. The 1950s appears to be an anomaly: when about 33% of the authors represented non-U.S. institutions. This could, however, be an artifact of indexing.
10. It might be noted that an analysis in the revision stage of this article found a steep increase in international authors: in 2014, the percentage was at 40%, 47% in 2015, and nearly 60% in 2016 (searched on November 20, 2016).

11. Authorships are instances of individual authors on a byline, rather than unique individuals. That is, if author A was a female and authored three papers, it would account for three female authorships.
12. A follow-up analysis during the revision stage of this paper found that women authorship increased to nearly 29% in 2014, but dropped to 20% and 23% in 2015 and 2016, respectively.
13. Web of Science provides only citations within the database. In other words, articles that cited *PAR* but were not indexed by Web of Science could not be located within this dataset and were thus not calculated in this analysis. Therefore, *PAR* citations are underestimated due to the limitations of data collection by the Institute for Scientific Information (ISI).
14. There are 191 journals in the 2013 *Journal Citation Report*. Among them, three journals are excluded in this analysis, since they were indexed in Web of Science only in the 2013 report and we cannot trace back to their previous citation practice. These three journals are: *Policy and Society*, *Ethics and International Affairs*, and *European Political Science Review*.
15. Please note that the journal list for PA and PS is from the 2013 *JCR* report only.
16. The low contribution rate of practitioners is also a function that our ISI data source is the Article. Practitioners regularly contribute in Reviews and Commentary.

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Supporting Information

Supplementary figures and tables may be found in the online version of this article.

Appendix A. PA and PS journals citing *PAR* most frequently (1940-2013)

Journal	WoS Category	1940-1964	1965-1989	1990-2013	#Total	%Total
Administration & Society	PA		288	1,442	1,730	16%
Journal of Public Administration Research and Theory	PA			1,276	1,276	12%
American Review of Public Administration	PA			1,254	1,254	11%
Public Administration	PAPS	4	35	512	551	5%
Policy Studies Journal	PAPS		165	308	473	4%
Public Personnel Management	PA		186	253	439	4%
International Review of Administrative Sciences	PA			388	388	4%
Public Management Review	PA			318	318	3%
Publius-The Journal of Federalism	PS		78	161	239	2%
Review of Public Personnel Administration	PA			226	226	2%
Australian Journal of Public Administration	PA		43	167	210	2%
Canadian Public Administration-Administration Publique Du Canada	PA		65	143	208	2%
Journal of Policy Analysis and Management	PA		32	176	208	2%
American Political Science Review	PS	100	74	31	205	2%
International Public Management Journal	PA			195	195	2%
Policy Sciences	PA		79	116	195	2%
Journal of Politics	PS	44	75	75	194	2%
Public Administration and Development	PA		42	150	192	2%
Governance-An International Journal of Policy and Administration	PAPS			180	180	2%
Administration in Social Work	PA		79	101	180	2%

Appendix B. Public Administration and Political Science Journals Referenced Most Frequently by *PAR* (1940-2013)

Journal	WoS Category	1940- 1964	1965- 1989	1990- 2013	#Total	%Total
American Political Science Review	PS	27	198	493	718	16%
Administration & Society	PA		72	485	557	12%
American Journal of Political Science	PS		21	295	316	7%
Journal of Public Administration Research and Theory	PA			314	314	7%
Journal of Policy Analysis and Management	PA		21	240	261	6%
Journal of Politics	PS	7	50	145	202	4%
American Review of Public Administration	PA			201	201	4%
Public Personnel Management	PA		44	142	186	4%
Social Science Quarterly	PS		36	144	180	4%
Public Administration	PAPS	11	5	155	171	4%
Publius-the Journal of Federalism	PS		20	123	143	3%
Policy Studies Journal	PAPS		28	108	136	3%
Annals of The American Academy of Political and Social Science	PS	3	34	69	106	2%
Policy Sciences	PA		38	62	100	2%
Political Science Quarterly	PS	13	16	48	77	2%
Public Opinion Quarterly	PS	2	26	34	62	1%
Governance-An International Journal of Policy and Administration	PAPS			58	58	1%
Public Choice	PS		8	34	42	1%
Political Studies	PS		5	36	41	1%
Australian Journal of Public Administration	PA			40	40	1%
Legislative Studies Quarterly	PS		2	38	40	1%

Appendix C. Unique Words for Each Time Period

(Listed in order of rank for time period), 1940-2013

1940-1964	1965-1989	1990-2013
organization	participate	performance
control	technology	governance
reorganization	response	lead
personnel	act	strategy
metropolitan	profession	effect
employment	nation	practice
department	use	develop
decision	urban	challenge
war	education	lessons
note	administrator	relate
field	regulation	private
career	managers	network
united	experience	make
technique	approach	reinvent
staffs	science	collaboration
region	productivity	accountable
legislative		nonprofit
coordination		municipal
training		implement
process		future
general		contract
defense		
agencies		
trends		
international		
budgeting		
british		
board		
area		

Table 1 Most Productive Authors, 1940-2013

Author	Articles	Author	Articles
Meier- KJ (E)*	22	Lewis- GB (E)*	15
Moynihan- DP (E)*	19	Lyden- FJ (E)	15
Perry- JL (E)*	19	O'Leary- R (E)	14
Rosenbloom- DH (E)*	18	Shore- WB (E)	14
Durant- RF (E)	17	Feiock- RC (E)	13
Wise-CR (E)	17	O'Toole- LJ (E)*	13
Golembiewski- RT*	16	Wright- DS (E)	13
Kraemer- KL (E)	16	Brudney- JL	12
Shipman- GA (E)	16	Kearney- RC	12
Bozeman- B	15	Schick- A (E)	12
Ingraham- PW (E)*	15		

Notes: Asterisks denote authors associated with one of the “75 Influentials” identified by the PAR Editorial Board in 2013.

Table 2 Institutions Affiliated with More than 1% of All Articles,
Listed in Rank Order by Productivity, 1940-2013

Institution	#Articles	%Articles	#Authors
Indiana University	123	3.1%	110
Syracuse University	122	3.1%	112
University of Georgia	112	2.9%	101
University of Southern California	81	2.1%	78
Florida State University	70	1.8%	78
American University	61	1.6%	53
University of North Carolina	58	1.5%	85
Georgia State University	51	1.3%	52
University of Kansas	49	1.3%	50
New York University	49	1.3%	55
Harvard University	48	1.2%	50
University of Missouri	45	1.1%	49
University of Wisconsin	45	1.1%	47
George Washington University	45	1.1%	50
Texas A&M University	41	1.0%	43

Notes: Data provided by Web of Science are not consistent for institution names. In some cases, a system-level institution is provided, but in other cases the campus-level institution, making it difficult to differentiate them. For example, “Indiana University” usually refers to the IU Bloomington campus. Formerly, individual campuses were identified by WoS; more recently, individual campuses have been subsumed under the system name.

Figure 1 Proportion of Papers Associated with All Academic, Profit/non-profit, Government, or Mixed Authorships by Decade, 1940-2013

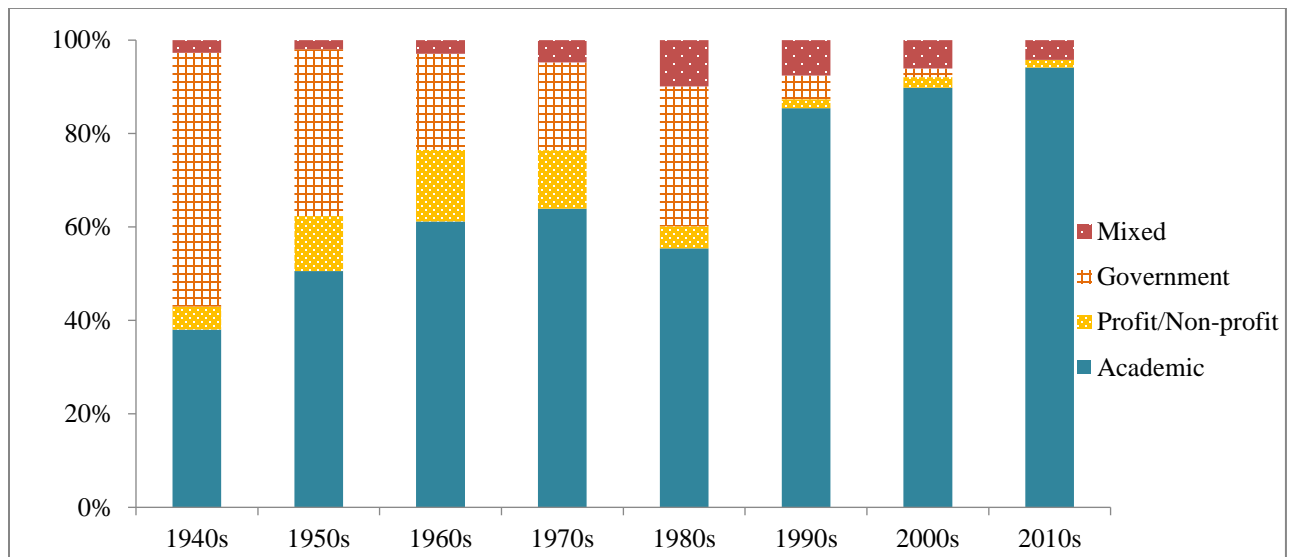


Figure 2 Gender Composition of the *PAR* Editorial Board by Decade, 1940-2013

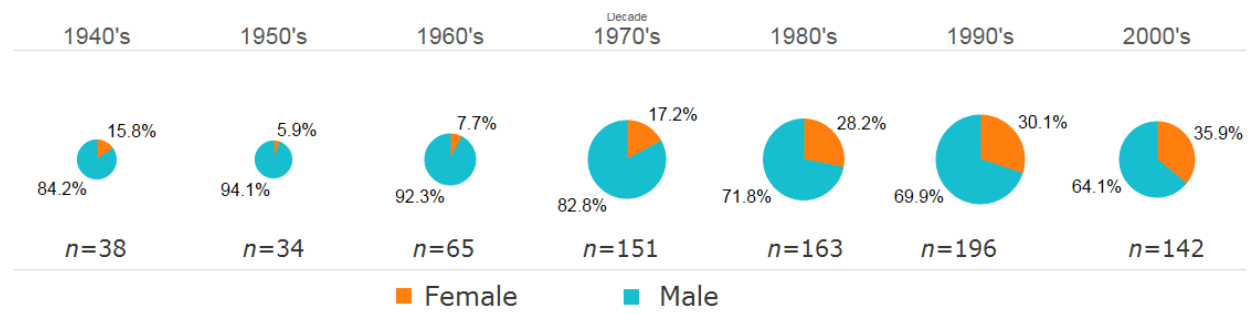


Figure 3 Proportion Contributions of Citations from 22 Core Disciplines by Time Period, 1940-2013

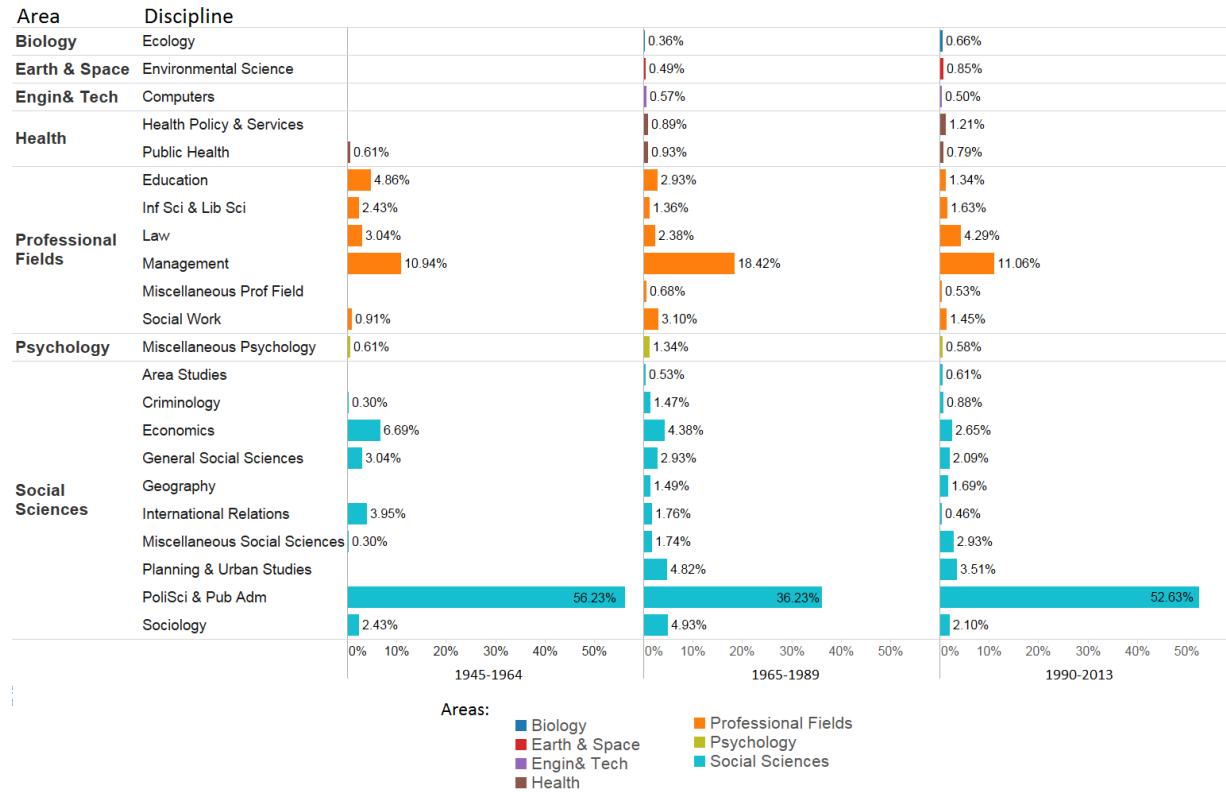


Figure 4 Proportional Representation of Cited Disciplines by Time Period (1940-2013)

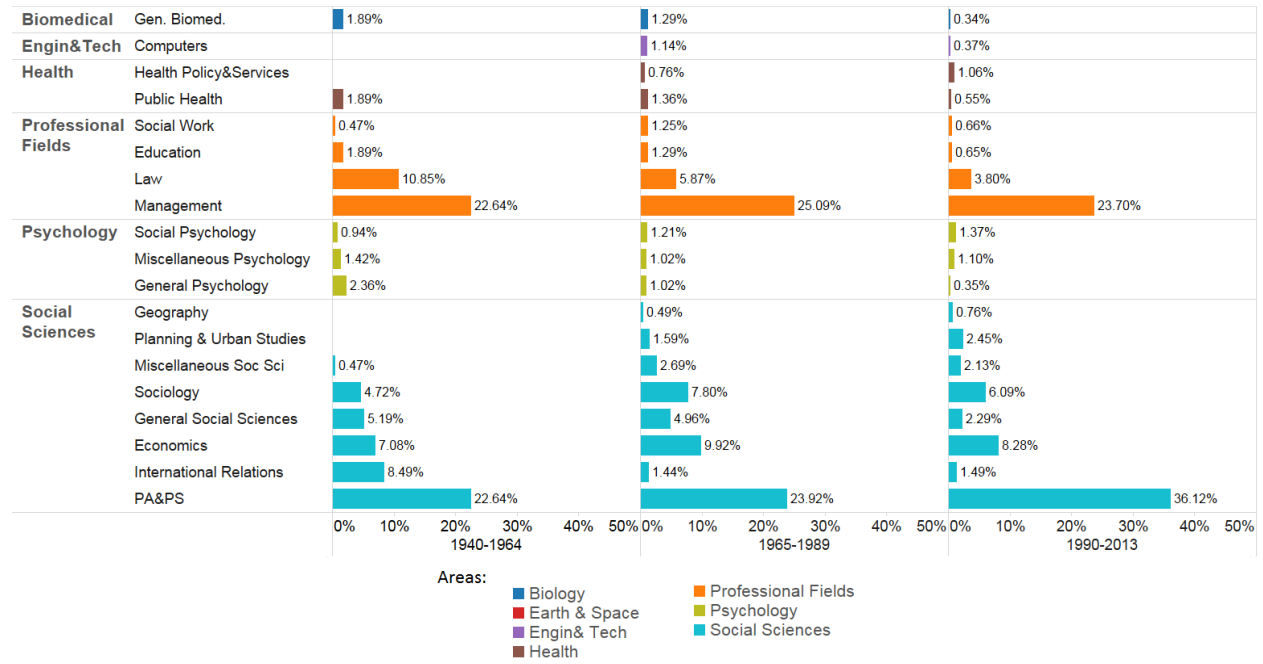


Table 3 Centrality of *PAR* in Three Co-citation Networks by Time Period, 1940-2013

	1940-1964		1965-1989		1990-2013	
	Value (mean)	Rank/Total	Value (mean)	Rank/Total	Value (mean)	Rank/Total
Degree	7($m=8$)	9/15	63($m=39.6$)	2/70	145($m=90.2$)	18/183
Closeness	21($m=20.3$)	6/15	75($m=101.1$)	2/70	219($m=275.4$)	18/183
Betweenness	0.1($m=3.13$)	10/15	43.4($m=16.0$)	5/70	126.5($m=46.7$)	20/183