From Little Science to Big Science: Were Women and Non-Elites Left Out?

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Abstract

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In Little Science, Big Science (1963), Derek J. de Solla Price undertook a sociology of science that dealt with the growth and changing shape of scientific publishing and the social organization of science. The focus of Price’s work was on the long-term, gradual shift from “little science,” with the solo scientist, small laboratory, and minimal research funds, to “big science,” with collaborative research teams, large-scale research hardware, extensive funding, and corporate-political suitors of scientists. We extend Price’s focus on scientific publications by moving beyond his analysis of practices in physics and chemistry to examine a social science; namely, sociology. Specifically, we analyze 3,000 articles in four long-standing sociology journals over the fifty-year period from 1960-2010 to determine the gender of authors, the prestige of authors’ departments, length of articles, number of references, sources of data for studies, and patterns of funding for research. We find that sociology is not immune from the shift from “little science” to “big science.”

Key Words:
Women, elites, non-elites, little science, big science, sociology journal publications

1. Introduction

In 1962, James Watson, Francis Crick, and Maurice Wilkins were awarded the 1962 Nobel Prize in Physiology or Medicine for discoveries of the molecular structure of nucleic acid, the building blocks of DNA. Several years later, in 1968, James Watson published The Double Helix: A Personal Account of the Discovery of the Structure of DNA. The award and the book were met with criticism for a number of reasons including the aggressive competition among laboratories pursuing the same scientific objectives, and for the intense relations among laboratories and scientists engaged in efforts to be first in making the new discovery. There was also criticism of how the competition resulted in ignoring contributions of those scientists who were less self-centered and who were left behind or lost in the competition. One public critic was Ann Sayre, the author of Rosalind Franklin and DNA (1975), a book that was...
critical of Watson’s “personal account” and argued that the team of Nobel Laureates had failed to give adequate credit for Franklin’s contributions to the discovery of DNA.

The pursuit of the Double Helix among the competing scientists was anything but the idealized norms of science discussed by the distinguished founder of the sociology of science, Robert K. Merton (1957), who argued that the guiding norms of science emphasized co-operation, sharing ideas, and avoidance of personal gain.

The competition to uncover the scientific foundation for DNA took place in an era of big laboratories, teams of researchers, and extensive funding from private and government sources. It was the era of what others would call “Big Science.”

1.1. Price’s Little Science, Big Science

By coincidence, in 1962, Derek J. de Solla Price, a Yale University historian of science, gave a series of lectures at the Brookhaven National Laboratories on the growth of science that were published in 1963 under the title of Little Science, Big Science (Price, 1963). The purpose of his lectures was to move beyond discussions of the increasingly crucial role of science in contemporary society and of its humanistic implications, and to “turn the tools of science on science itself.” In short, Price was undertaking a sociology of science that would deal statistically with the growth and changing shape of scientific publishing and the social organization of science. One of his objectives was to identify some mathematical principles that could account for such empirical regularities as the growth of the number of scientists, of scientific publications, and of the publication rates of “eminent” scientists and “ordinary” scientists.

The focus of Price’s work was on the long-term, gradual shift from “little science,” with the solo scientist, small laboratory, and minimal funds, to “big science,” with collaborative teams, large-scale research hardware, extensive funding, and corporate-political suitors. Price provided extensive statistical data on the growth of scientific manpower, scientific journals and societies, and scientific abstracts and papers. He was aware of the research of well-known sociologists of science such as Robert Merton (1957), citing his publications on priority claims and disputes among scientists, and Bernard Barber for his 1963 paper on multiple discoveries in science and scientists’ cautious approach to accepting new discoveries.

1.2. Current Currency of Price’s Work

Although Price’s writings appeared over 50 years ago, they have an odd currency on a number of points. For example, when examining statistics on the growth of scientific periodicals he notes that the history of the scientific paper reveals that they began as a solution to the problem of “too many books,” and insufficient time for scientists to read them. He noted that great controversy accompanied the transition from publishing books to publishing papers, and commented on the expanded role of the citation of references in scientific papers in 1850 and of their serving multiple purposes. One purpose of the expanded use of references was in response to the growth of scientific publications and the need to show how each paper built on the foundation of previous work. He also discussed a less scientific purpose for the expansion of citations, namely, the desire to assert claims of intellectual property in the face of the increasing possibilities of multiple discoveries.

Another modern aspect of Price’s work is his discussion of the “invisible college.” In apparent response to the growth of scientific manpower and scientific papers which accompanied the transition from Little Science to Big Science, groups composed of
a small number of scientists began to form unofficial specialist societies associated with common subject matter, and they devised means to enhance communication via the mailing of preprints, reprints, and opportunities for physical contact. Price recognized that such small networks (“groups composed of our maximal 100 colleagues”) would take on the character of an elite group of scientists.

The discussion of the invisible college rarely moved beyond the level of individual scientists to encompass the actions of collectivities such as universities or academic departments within universities. Although Price was clearly aware of the competitive nature of Big Science, his focus was not on competition at the institutional level of universities and academic departments.

2. Publications in Sociology

In our research, we extend Price’s focus on scientific publications in the era of Big Science by moving beyond his analysis of practices in physics and chemistry to examine a social science, namely sociology. In order to determine if there has been a comparable shift to Big Science in sociology, we focus on publications appearing in the four leading academic journals in sociology during the period 1960 to 2010, namely, *American Sociological Review, American Journal of Sociology, Social Forces, and Social Problems*.

Our sample is based on the population of journals that is ordered by decade and we use systematic sequential sampling for each decade, selecting the first year of the decade (for example, 1960), the fifth year of the decade (for example, 1965), and the last year of the decade (for example, 1969). For each decade, we selected for coding all issues of the journal for each of the three sampled years. Our sample is a total of 3,000 articles from the four journals.

Every article was subjected to coding operations, excluding research notes and the presidential address. For each article, the following measures were used:


2) Length of articles in terms of number of published pages; and number of references;

3) Whether the article was primarily theoretical versus empirical (used some kind of data);

4) Source of data used in each published article (secondary data – national data sets, census tapes; primary data via questionnaires or interviews or ethnographic; archival data; other sources).

5) Source of funding, if any (internal or external – federal or other), as provided by the authors themselves, usually in an initial footnote in their articles.

Our analysis of published work examines five questions:

(1) What are the academic locations and gender of the authors of articles across the five decades?

(2) Has length of articles and number of references changed over time?

(3) Has the nature of articles changed from theoretical to empirical?

(4) What are the sources of data used in publications?

(5) Have patterns of funding for research changed over time?

Our analysis of publications in these journals over a 50-year span contains an explicit focus on the larger institutional context of academic publication. This means that we view publications within the context of a stratified system of higher education, at the level of colleges and universities, and a stratified system of academic departments in the discipline of sociology. The questions about publication practices noted above may be associated with a possible shift to Big Science, but also whether the era of Big Science was associated with increased competition for research funding and in discipline-based publication practices. Price expected that Big Science would bring with it increased competition for funds, and for faculty and graduate students that could contribute to success in acquiring research funds and in the greater academic prestige that would follow.

When universities and departments compete for these scarce resources, they may, albeit unintentionally, foster forms of inclusion and exclusion that result in the creation of elite and non-elite universities and departments. Thus, an unanticipated consequence of Big Science is greater individual and institutional competition for recognition, thereby producing a small number of elite departments/universities that provide the necessary resources to their faculty to advance the interests of their departments and universities. The process was described by Merton (1968) as the Matthew Effect, whereby departments with abundant resources will be able to provide their faculty with levels of support that enhance their research programs and publications thereby maintaining or enhancing their standing among peers.

4. Findings

Our research findings dealing with the question of who publishes in leading sociology journals indicate that about 40 percent of all authors are from top 20 departments, and another 40 percent of authors who are not on the faculty of top 20 departments, but who received their PhD from those top 20 departments. Thus, over 80 percent of authors are linked to the top 20 departments.

Preliminary findings on other research questions indicate the following:

- The proportion of authors who are women has increased over the years, but remains below the proportion of women sociologists in the discipline (ASA 1965-2005);
- Length of articles and number of references have increased markedly;
- Articles are increasingly empirical in nature.
- More recent articles are based on national data sets collected by third parties rather than data collected by individual investigators.
- In recent years, most published articles are based on research funded by national agencies (e.g. NSF, NIMH, NIA) or private sources.

5. Discussion

The institutional affiliation of authors in four long-standing sociology journals between 1960 and 2010 provides evidence of the dominance of faculty from the top ranked departments of sociology. The gender of authors over time indicates some increase in women authors, but these numbers are well below the proportion of women sociologists in academic departments. We believe that these data patterns are consistent with a theoretical framework for understanding how social closure may operate in the
publication process, namely, demographic social closure based on the distribution of faculty across academic departments, and competitive social closure based on the efforts by departments to maintain or enhance their standing in prestige hierarchies. We are continuing our research in this area by focusing on knowledge social closure that is linked to the professional socialization of sociologists. In addition, we are examining the research topics contained in the published papers in the four journals, focusing on changing research interests over time and gender differences in the interests.

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