

The Sociology of Authorship Sequence

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Laboratory activity [is] the organization of persuasion through literary inscription
(Latour and Woolgar, 1986)

INTRODUCTION

The driving force for science long has been considered to be curiosity of the natural world. However, at present, there are other mundane issues that are also involved such as earning a living since most scientists now are involved in salaried jobs either in academia, government, or industry. Another continuing driving force in science, often not openly mentioned, is the recognition and fame that come with advances and discoveries. In science as in many other pursuits, credit and acclaim is often based on priority, i.e. who is the first. In fact, priority may be the most important component in which the rewards of science are allocated and special prizes, such as the Nobel, are based on this issue. Priority in science is now determined in a special way, the date of first publication in a recognized scientific journal, where the editors, the gatekeepers of science, have developed special procedures (a series of anonymous peer reviews) to determine if the new discovery and the experimental data to back it up are considered legitimate. Similar rules exist in sports, where priority for achieving a certain event such as speed over a certain distance, must be achieved in a sanctioned, competitive event. For example, photographic evidence for an event run in a non-sanctioned meet does not count.

At present, unlike the great scientific works of Copernicus, Newton, Linnaeus, and Darwin, research results are seldom published by an individual in a very large paper or book where the results are essentially complete. It is also unusual that great scientific papers such as those of Mendel or Einstein have a single author. Present day research papers are typically multi-authored and reported in a series of discrete units. There is a certain tension since scientists are loath to delay publication of individual definitive experiments because of the fear of being scooped, as well as the need to provide evidence of progress for their job or grant, while research journals are averse to publish individual experiments. Thus, determining priority over a particular series of publications is not straightforward but complicated. Since authorship is listed sequentially, one might expect that sequence is critical but the issue is more complex. This essay on the sociology of authorship sequence has a narrow objective: how does the scientific community determine and evaluate authorship sequence.

AUTHORSHIP SEQUENCE

The unit of scientific information is the research paper. One of the curious developments in scientific publications is the changing attitudes toward authorship sequence. What might seem to be a simple easily resolvable issue turns out to be fraught with complication and difficulties. Let us review the various issues of this phenomenon.

No Author At All

A number of books and articles are authorless. In this case it must be presumed that either the author chooses to remain anonymous, or that the report is merely a matter of a complex committee without a single author. In newspaper writing, the author is usually not listed, and getting a byline is considered a great coup. Articles without authors are usually cited as "Anonymous" abbreviated as "Anon." Complications arise when the author is finally revealed. Jane Austen's famous novel *Pride and Prejudice* was originally published as "written by the author of *Sense and Sensibility*" – which was also anonymous. In some cases the anonymous author provides another name (nom de plume, penname, pseudonym). Famous pseudonyms in literature include George Sand for Amantine Lucile Dupin and Mark Twain for Samuel Clemens. In science, the most famous case is the statistician W.S. Gossard (1876-1937) who published under the name Student. All biologists are familiar with the Student t-test.

Single Author

This would seem to be uncomplicated but may not be. Check the "acknowledgement" section. Effusive acknowledgements lead the reader (and often the person acknowledged) to wonder why authorship was not shared.

Two Authors

The co-authorship of an article would seem straight forward but one wonders, why the sequence. The first author is usually considered the senior author (not older, but presumably more important) and the second author, the junior author. With equal participation in the work it is often a problem of determining who gets senior status. One way to resolve this issue, besides flipping a coin, is to use alphabetization

of the names. Thus, only when the sequence is non-alphabetical does it become absolutely clear that the first author is non-ambiguously positioned as the senior author, with major responsibility for the work. Playing second fiddle in authorship is a very unpleasant situation for some and often the cause of deep resentment among colleagues. Senior authorship is valued in academia and the lack of senior authorship in CVs is a signal that the person is a follower and not a leader. When multiple publications evolve from the work, this problem can be neutralized by the two authors shifting position. The sequence of names has important effects. Thus, we refer to Watson-Crick base pairing of nucleotides in DNA, and Murashige-Skoog culture medium. (It is said that Henry Royce told Charles Stewart Rolls when discussing the name of their firm that Royce-Rolls had a nice ring to it!)

There have been differences in determining sequence. In the 19th and early 20th century the professor and not the student assumed senior authorship. In departments of Mathematics and English authorship between professor and student is seldom shared, with authorship reserved for the student. This has enormous consequences in the professor-student relationship. In the biological and medical sciences, having graduate students is extremely important to increase the potential bibliography of the professor. One would think that a professor's publication record would be divided by the number of authors but this does not seem to be the case.

There is another complication in science. When the co-worker in a project is a graduate student, the graduate student usually receives the honor of senior author. However, when the co-worker is an employee such as a laboratory assistant, authorship is not universally endowed under the dubious claim that the technician was simply paid to follow instructions. The surest way to get to be senior author in a scientific paper is to write the first draft, which is often the main work.

There are strong cultural factors in authorship sequence. In Italy for example, it is said that the "Professor" who sometimes does not write even a line or otherwise contribute to the work is often the main author. A common complaint is that "slave" students, contract workers, or assistant professors do the work while the professor takes the credit.

Three Authors

Ah, here we have a problem: there are now three places: first or senior author, middle author, and last or junior author. The most important position is the first authorship, but strangely enough

the second authorship is considered to have different importance in different cultures. In the United States, the power position by custom is relegated to the last author. Many scientists will agree to be only first or last author distaining the middle position. Thus, the contribution of the poor middle author is stuck in ambiguity. One resolution of assuming equal participation is alphabetization. But with three authors there are 6 possible arrangements (ABC, ACB, BAC, BCA, CAB, CBA). With randomness, one sixth of the time authors will be in alphabetical order anyway.

Multiple Authors

In this case the first and last author are given power positions in scientific publications. Usually the last author is the laboratory director or senior professor. The sequence of middle authors now assumes critical importance. Thus with 6 authors, being third rather than fourth seems to say something about the contribution of each. The second author may often feel especially put out assuming that person has contributed substantially. There is a tendency to resolve this issue with a footnote that usually runs as follows: *Each author has contributed equally to this work.* However, this statement is fraught with ambiguity, but who cares? The short answer is the second author. Another complication is identification of the "contributing author," the one who sends in the paper and presumably is the one to whom requests for reprints are sent. For some reason contributing author retains some panache. I do not know why.

Interdisciplinary Multi-Authored Papers

Modern science is often done in large interdisciplinary teams and often the entire group shares authorship with the assumption that each has contributed in some way or another. As many

as 100 authors have been involved in some papers. Now in some journals when these articles are cited often only the first three authors are listed and the rest are indicated by the humiliating term either "etc." or "et al." Thus in this situation it is considered important to be at least the third author in a multiple authored paper. I told you this was not easy.

In the past five years there has been a sea of changes developing in identifying each authors' contribution in multi-authored papers by influential journals such as the *Proceedings of the National Academy of Science (USA)*. This has come about as a result of author disputes as well as charges of scientific misconduct. Funding agencies are now requiring statements on which authors received funding while journals require declarations on the contributions of each author such as conceptualization and design, performance of specific experiments, data analysis, and writing. This trend will certainly filter down to all journals.

In multi-authored papers there have been differences on whether technicians or paid laboratories (such as sequencing firms) deserve authorship. The payment of large publishing fees, especially color, has also been a factor in consigning authorship. With larger and larger interdisciplinary teams, acknowledgement of authorship is becoming of increasing importance and issues still remain to be resolved.

CONCLUSIONS

Authorship sequence in the last analysis is a way to determine the share of participation of a particular work. It is part of a complex system of determining rewards in science. These rewards are now based on an integration of a number of factors such as authorship sequence, the number of publications, the importance of

the journal that publishes the paper and its impact, the number of citations of the results, and above all priority. Modern science is now based on multi-authored works in which complicated rules and traditions have been developed to determine authorship contribution in each paper. The system is evolving. Unfortunately the present system is not uniform with different fields and has encountered many problems and as for most complex problems there is no simple solution.

REFERENCES

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