by Lynn Dirk

The Scientific Paper: Through the Magnifying Glass

The scientific paper is the polished, faceted report of the long and winding work of scientists. Therefore, among those who study communication or science, one would think the scientific paper would be an object of frequent study. Not so. Although citation studies, which abound, do address one aspect, research on the scientific paper per se is scant. One possible explanation for the remarkable oversight is that the scientific paper is so much a part of what scientists do that studying it would be like an eye examining an eye. The works below are therefore notable in focusing on the scientific paper.

de Solla Price D. The development and structure of the biomedical literature. In: Warren KS, editor. Coping with the biomedical literature. A primer for the scientist and the clinician. New York: Praeger; 1981. p 3-16.

Almost 15 years after his classic work, *Big Science, Little Science*, de Solla Price here provides an excellent overview of the scientific literature with special consideration of the biomedical literature. He says at the very start that "the technique of the scientific paper, though simple and probably accidental in origin, was revolutionary in its effect. The paper became not just a means of communicating a discovery but, in quite a strong sense, it was the discovery itself."

Mullins N, Snizek W, Oehler K. The structural analysis of a scientific paper. In: van Raan AFJ, editor. Handbook of quantitative studies of science and technology. New York: Elsevier Science; 1988. p 81-105.

Nicholas Mullins (1939-1988), a prodigious and wide-ranging scholar (he promoted personal computers before Windows!) prominent in the Society for Social Studies of Science, died of cancer the same year this work was published. It proposes a research program to look at every aspect of the scientific paper, an "underutilized resource in empirical examinations of science". From title to references, from visual aids to discursive style and word use, every aspect of the paper is analyzed for how it could yield valuable information about the practice of science. The proposed research program has yet to be realized.

Bazerman C. Physicists reading physics: schema-laden purposes and purpose-laden schema. Written Communication 1985;2: 3-24. Reprinted in Bazerman C. Shaping written knowledge. The genre and activity of the experimental article in science. Madison (WI): University of Wisconsin Press; 1988.

Bazerman, now a professor of English and education at the University of California, Santa Barbara, studied how seven physicists read scientific papers. The physicists underwent a general interview and observation of and focused interviews about how they (1) conducted a library search for materials and a first scan of them while still in the library and (2) carefully read specific articles. Definite strategies in selecting and reading articles emerged. For example, reading strategies for articles that were very difficult to understand, whether because poorly written or presenting new material, differed from those for articles about unsolved but well-defined problems. Interest was triggered by names of researchers, methods, or objects or phenomena.

Burrough-Boenisch J. International reading strategies for IMRD articles. Written Communication 1999;16:296-316.

Fueled by a debate about whether the IMRD, or IMRAD, format (introduction, methods, results, and discussion) of the scientific paper is a beneficial or adverse influence in science, Burrough-Boenisch compared strategies of persons reading as scientists, editors, or reviewers. Reading in the IMRD sequence was used by 55% reading-as-editor but only 17% reading-as-scientist. "The scientist can risk reading

strategically because the article's integrity has been vetted by the guardians of the standards of the discourse community." However, the "sheer predictability [of IMRD] enables readers to use it to create the reading strategy most appropriate for their situation." As an aside, since the 1940s titles of scientific papers have become more informative and IMRD sections contain more subheadings (citing Berkenkotter and Huckin).

Dirk L. From laboratory to scientific literature: the life and death of biomedical research results. Science Communication 1996; 18: 3-28.

and

Dirk L. A measure of originality: the elements of science. Social Studies of Science 1999;29:765-76.

These articles report on a method of assessing scientific originality based on how the elements of the scientific paper—introduction, methods, and results—correspond to the hypothesis, methods, and results of studies. In a particular paper, each element contains information either previously reported in the scientific literature or being newly reported. Portraying originality as a permutation of previously or newly reported elements yields eight types of originality ranging from all three elements having been previously reported (P-P-P) to all three being new (N-N-N). In between would be, for example, a work with a newly reported hypothesis, previously reported methods, and newly reported results (N-P-N).