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NORMATIVE CRITERIA FOR SCIENTIFIC PUBLICATION

PD 015

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Norms of the scientific institution have been intuitively outlined by Merton (1957:550–561) and by Barber (1962: 122–142). These include universalism, organized skepticism, communism, disinterestedness, rationality, and emotional neutrality. Merton analyzes such norms as they function to maintain the autonomy of science, and he deals particularly with conflicts between the norms of science and the norms of other social institutions.

Storer's analysis of these six norms (1966:75–90) is based upon a conception of science as a social system. He describes scientific norms as they provide a mechanism for the allocation of the commodity of competent response among scientists. From this perspective, he challenges Merton's functional explanation and argues that the norms are important to scientists "because they concern something in which scientists have an immediate stake, not because they are beneficial over the long run to scientists as a whole" (1966:84).

There are two significant questions raised by these attempts to account for the operation of scientific norms: (1) to what extent are the aforementioned norms shared by scientists?; and (2) do such norms, as they have become institutionalized in the structure of the scientific community, actually contribute to the major goal of science—namely, the build-up of valid scientific information?

The latter question concerns both the quantity and the quality of scientific information. The large quantity of information is easily documented. Much has been written of the "information explosion" in scientific publications (Price, 1962). The issue of the quality of scientific information until quite recently has elicited substantially less objective consideration. The work of the Columbia program in the Sociology of Science has shed some light upon this issue. The Coles (1967) concluded that recognition of 120 university physicists was dependent primarily upon the quality, rather than the quantity, of publication (quality being judged by citations to the scientists' work).

But what about the information that is rejected by the referees of the reception system of science? Crane's (1967) study of three social science journals provides systematic evidence of "extra-rational" influences upon gatekeepers. The distribution of characteristics such as academic affiliation, doctoral origin, and professional age of contributors to the three journals was similar to the distribution of these same characteristics among the journal editors. She suggests that the important factor explaining these results is not personal ties, but similarity of academic training, methodology, theoretical orientation, and mode of expression.

Hagstrom (1965:172–173) goes beyond the evaluation of individual contributors to science to consider the relative judgments of scientific specialties and disciplines. He suggests that the prestige of information-holding groups is judged by the extent to which their information is utilized in another area of scientific endeavor. Thus, the more developed sciences are more prestigious because other specialties and disciplines lower in the developmental hierarchy are dependent upon and refer to information from them, whereas information from the less developed group is not so often used.

Storer's distinction between the hard sciences and the soft sciences (1967:78) follows Hagstrom's lead. The operational indicator of the hardness of a discipline is the extent to which it uses mathematics, for mathematics allows greater precision in organizing information and thus a tougher set of criteria for evaluating contributions. Thus, the quality of scientific writing may well be judged relative to the existing state of knowledge in its field. Such an approach recognizes the complexity of judging the quality of scientific information utilizing universalistic criteria.

Methods

One way to examine the operations of the evaluation and recognition systems of science is to determine the criteria that are actually used by scientists to evaluate scientific publications. Such an analysis brings the norms and goals of science down to the level of their technical implementation in the reward system. A list of criteria for scientific publications was developed for this research from several sources (Parsons, 1951:335–345; Fiegel, 1953; Gruenberger, 1964). The ten criteria are:

1. Originality
2. Logical rigor
3. Compatibility with generally accepted disciplinary ethics
4. Clarity and conciseness of writing style
5. Theoretical significance
6. Mathematical precision
7. Pertinence to current research in the discipline
8. Replicability of research techniques
9. Coverage of significant existing literature
10. Applicability to "practical" or applied problems in the field

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The sample utilized for the study was drawn systematically from an up-to-date list of all resident professors above the rank of instructor employed in sixteen selected departments at a "Big Ten" university. These scientists were asked to judge whether each of the criteria listed above were "essential," "very important but not essential," "somewhat important," or "not very or not at all important" for scientific writings in their discipline. Questionnaires were mailed to 313 scientists, 62 per cent of whom responded.

Responses were compared between natural scientists ($N=105$) and social scientists ($N=86$). This categorization follows Storer's conceptualization (1967:78) and was designed to represent the hard-soft dimension. The departments were:

Natural (Hard) Sciences	*Social (Soft) Sciences*
Agronomy	Agricultural Economics
Animal Sciences	Audiology
Biochemistry	Economics
Botany	Education
Chemistry	Political Science
Entomology	Psychology
Horticulture	Sociology
Physics	

Data were also gathered for the number of papers published by these scientists. This measure of productivity also provides an estimate of the scientists' prestige, but it is admittedly not the best measure available.[1]

Results

The evaluation of the ten criteria resulted in the overall rank-ordering shown in table 1. Ranks are based upon the percentage of respondents who deemed the attribute "essential." Perhaps the most intriguing aspect of the rankings is the closeness between "clarity and conciseness of writing style" and "originality," ranked third and fourth respectively. This finding suggests very definitely that technical considerations of publications are at least equally as important in judging the worth of scientific information as the end goal of adding to the existing body of scientific knowledge. The number 1 and number 2 rankings of "logical rigor" and "replicability of research techniques" also attest to the necessity for establishing universalistic criteria by which to judge scientific contributions. Furthermore, "mathematical precision" was rated essential by nearly twice the number who rated "theoretical significance" essential (30 per cent compared to 16 per cent). The assignment of "applied significance" to the lowest rank speaks for itself.

In short, publication criteria (at least as viewed by these scientists) can be said to be geared primarily to the technical problems involved in the "just allocation of the commodity of competent response," in Storer's (1966) words. The problem of providing recognition for quality work can only be resolved by agreement in the scientific community on standards of judgment, and this agreement is facilitated by the utilization of precise, often quantitative criteria. Crane's results are quite understandable in this context: similarity in the academic backgrounds of a journal editor and of a submitting author facilitates the judgmental process by providing a common framework of discourse.

TABLE 1. RANKING OF CRITERIA USED TO EVALUATE SCIENTIFIC WRITING

Criterion	Rank	Per Cent Who Rated Criterion "Essential" ($N=191$)
Logical rigor	1	59
Replicability of research techniques	2	53
Clarity and conciseness of writing style	3	43
Originality	4	42
Mathematical precision	5	30
Coverage of significant existing literature	6	25
Compatibility with generally accepted disciplinary ethics	7	22
Theoretical significance	8	16
Pertinence to current research in the discipline	9	12
Applicability to "practical" or applied problems in the field	10	6

The differences revealed between natural and social scientists also support such an interpretation. Chi-square values significant to at least the .05 level of probability (utilizing the more conservative two-tailed test) were obtained for seven of the ten criteria (see table 2). Natural scientists placed more emphasis on the qualities of replicability of research techniques, originality, mathematical precision, and coverage of the literature, whereas social scientists gave higher ranking to logical rigor, theoretical significance, and applied significance. It would appear that more precise mathematical and technical criteria are used to evaluate scientific writing in the natural sciences, as opposed to a dependence upon less defined logico-theoretical standards in the social sciences. Also worthy of note is the relatively higher importance attached to originality in the natural sciences. This would seem to be related to the more competitive nature of the harder sciences, where more precise quantitative analysis of the new can be made.

The findings in table 2 lend support to Storer's characterization of the hard and the soft sciences, and they point to the importance of disciplinary variations in the evaluation and reward system of science. The findings also hold practical import for the development of communication mechanisms in scientific disciplines. Hard information can be more easily abstracted and stored on computer tapes than can soft information. Hence, natural scientists make more use of indexes and abstracts (that are increasingly computerized), whereas social scientists depend more heavily upon the review article and the literature survey (Committee on Information in the Behavioral Sciences, 1967:11). Disciplinary

[1] The Coles (1967:385) found correlations for quantity of research with other measures of prestige ranging from .24 to .49.

TABLE 2. IMPORTANCE OF CRITERIA FOR SCIENTIFIC WRITING TO NATURAL AND SOCIAL SCIENTISTS

Criterion	(N)	Per cent in Response Categories[a] 4	3	2–1	0	X^2 Value[b]
Logical Rigor						
Natural scientists	(105)	48.6	36.2	9.5	5.7	9.08
Social scientists	(86)	72.1	19.8	7.0	1.2	$p<.02$
Replicability of Research Techniques						
Natural scientists	(105)	62.9	18.1	12.4	6.7	11.38
Social scientists	(86)	41.9	24.4	29.1	4.7	$p<.01$
Clarity and Conciseness of Writing Style						
Natural scientists	(105)	44.8	41.0	13.3	0.9	.39
Social scientists	(86)	41.9	39.5	16.3	2.3	NS
Originality						
Natural scientists	(105)	48.6	39.0	9.5	2.9	6.42
Social scientists	(86)	33.7	45.3	19.8	1.2	$p<.05$
Mathematical Precision						
Natural scientists	(105)	36.2	31.4	20.0	12.4	14.06
Social scientists	(86)	22.1	20.9	44.2	12.8	$p<.01$
Coverage of Significant Existing Literature						
Natural scientists	(105)	35.2	23.8	40.0	0.9	12.34
Social scientists	(86)	12.8	34.9	48.8	3.5	$p<.01$
Compatibility with Generally Accepted Disciplinary Ethics						
Natural scientists	(105)	23.8	16.2	39.0	21.0	2.94
Social scientists	(86)	19.8	16.3	50.0	14.0	NS
Theoretical Significance						
Natural scientists	(105)	7.6	40.0	43.8	8.6	10.57
Social scientists	(86)	25.6	34.9	36.0	3.5	$p<.01$
Pertinence to Current Research in the Discipline						
Natural scientists	(105)	12.4	21.9	62.9	2.9	3.45
Social scientists	(86)	11.6	32.6	52.3	3.5	NS[c]
Applicability to Practical or Applied Problems						
Natural scientists	(105)	3.8	15.2	72.4	8.6	10.45
Social scientists	(86)	9.3	25.6	62.8	2.3	$p<.01$[d]

[a] 4: "Essential," 3: "Very important but not essential," 2: "Somewhat important," 1: "Not very or not at all important," 0: No opinion or uncodable responses were eliminated in computation of chi-square, except for the ethics and mathematical precision items.

[b] Two-tailed tests. "NS" indicates that the value is not significant at the .05 level.

[c] Categories 2 and 1 were separated for computation of chi-square.

[d] Categories 4 and 3 were combined and categories 2 and 1 were separated for computation of chi-square.

variations are also likely to affect the "life span" of published scientific information. Data can be expected to have a shorter life span in the hard sciences. Thus, the risk of duplicated research is greater, and there is more competition. As a result, informal sources of information are important.

The final variable employed in the research is that of productivity, which, in turn, is related to prestige. Hagstrom has suggested that more productive scientists in high prestige departments may be more subject to scientific norms as well as more integrated into communication structures (1968:12). The prestige variable could well have influenced the findings of this study, since the natural science departments at the university where the study was conducted tended to have higher prestige than the social science departments. However, when productivity was controlled, the differences between the natural and social sciences remained (see table 3). Inspection of the mean ratings reveals only slight, inconsistent differences between scientists who have published sixteen or more papers and those who have published less than sixteen. Differences betwen natural and social scientists hold, however. Productivity cannot be explained by their differential knowledge of technical norms.

TABLE 3. IMPORTANCE OF CRITERIA FOR SCIENTIFIC WRITING TO PRODUCTIVE AND NONPRODUCTIVE SCIENTISTS

	Mean Ratings[a]			
	Natural Scientists		Social Scientists	
Criterion[b]	0–15 Published Papers (N=45)	16 or More Published Papers (N=60)	0–15 Published Papers (N=54)	16 or More Published Papers (N=32)
Logical Rigor	3.36	3.43	3.65	3.68
Replicability	3.50	3.54	3.04	3.13
Style	3.31	3.31	3.30	3.16
Originality	3.31	3.40	3.11	3.00
Mathematical Precision	3.08	3.18	2.58	2.63
Coverage of Literature	2.45	2.98	2.56	2.42
Ethics	2.53	2.81	2.38	2.45
Theoretical Significance	2.45	2.54	2.85	2.87
Pertinence to Current Research	2.07	2.19	2.20	2.31
Applied Significance	1.85	1.70	2.29	2.03

[a] For response categories used to calculate means, see table 2, footnote a.

[b] Complete titles of criteria are in table 1.

Additional study of the prestige variable by disciplines is necessary. It could be predicted, for example, that the Coles' conclusion that the recognition of physicists is more closely related to the quality rather than the quantity of their publications would not hold for softer sciences. If quality is more difficult to determine in these disciplines due to their lower stage of development and their lesser utilization of precise, mathematical criteria, then prestige should be less clearly related to the quality of the contribution.

Conclusions

Disciplinary variations in the norms used to evaluate scientific information for publication appear to be related to the stage of development of the discipline's knowledge base. The results of this study indicate that the harder natural sciences stress precise mathematical and technical criteria, whereas the softer social sciences emphasize less-defined logico-theoretical standards. The prestige of individual scientists does not affect these disciplinary differences, which remain when productivity is held constant. Variations in publication criteria influence the process of prestige allocation for scientific contributions. For the contributor, the process is more competitive in the harder sciences, because the bases of quantitative evaluation are more developed. For the gatekeeper, judgments can be made with less ambiguous guidelines in the natural sciences. As a result, it is likely that the quality and the quantity of scientific publications are more closely related in the harder sciences. In the social sciences, on the other hand, "extra-rational" influences upon the judgments of gatekeepers should be more pronounced. If this interpretation is correct, further study of the reward system of science would profit from a multidisciplinary approach.

References

Barber, Bernard
1952 Science and the Social Order. New York: Crowell Collier and Macmillan.

Cole, S. and J. R. Cole
1967 "Scientific output and recognition: a study in the operation of the reward system in science." American Sociological Review 32 (June):377–390.

Committee on Information in the Behavioral Sciences
1967 Communications Systems and Resources in the Behavioral Sciences. Washington, D.C.: National Academy of Sciences.

Crane, D.
1967 "The gatekeepers of science: some factors affecting the selection of articles for scientific journals." American Sociologist 2 (November):195–201.

Fiegel, H.
1953 "The scientific outlook: naturalism and humanism." Pp. 8–18 in Herbert Fiegel and May Brodbeck (eds.), Readings in the Philosophy of Science. New York: Appleton-Century-Crofts.

Gruenberger, F.
1964 "A measure for crackpots." Science 145 (September 25):1413–1415.

Hagstrom, Warren O.
1965 The Scientific Community. New York: Basic Books.
1968 "Departmental prestige and scientific productivity." Paper presented at the annual meetings of the American Sociological Association.

Merton, Robert K.
1957 Social Theory and Social Structure. Glencoe, Ill.: Free Press.

Parsons, Talcott
1951 The Social System. New York: Free Press.

Price, D. J.
1962 "The exponential curve of science." Pp. 516–524 in Bernard Barber and Walter Hirsch (eds.), The Sociology of Science. New York: Free Press.

Storer, Norman W.
1966 The Social System of Science. New York: Holt, Rinehart and Winston.
1967 "The hard sciences and the soft: some sociological observations." Bulletin of the Medical Library Association 55 (January):75–84.

A PLAN TO IMPROVE THE ATTRIBUTION OF SCHOLARLY ARTICLES

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In a recent article, Harriet A. Zuckerman (1968) showed that there is much ambiguity in the present system of attributing jointly written articles. Because of this, the reader's knowledge of who did what is less than it might be. Worse, injustice and unpleasantness sometimes result. The problem is sufficiently important that men such as Walter B. Cannon (1945) and W. I. B. Beveridge (1957) have devoted thought to the decencies and difficulties of attribution, but without suggesting anything other than personal honor and generosity.

It makes sense, then, to consider amending the attribution system to provide more complete information on which author is responsible for what. This note proposes such a system, the use of which would require no extra space or scientific cost.

Credit for authorship of books is seldom a problem. Where there are coauthors, it is common practice to spell out in the introduction the exact facts of the collaboration: who wrote what, who initiated the project, who did the field work, and so on. But, as Miss Zuckerman discussed, the clues about jointly authored professional articles are more ambiguous. The reader of an article has no information to go on except the order of the authors' names, plus his personal knowledge of the authors and their work. The latter may cause the rich in reputation to get richer, deservedly or not. And the former is remarkably unspecific. It may mean that the two authors listed their names alphabetically intending to split the credit, or it may indicate a real author and one whose name was tagged on as a courtesy gesture, or the first-named author may be a usurper by dint of his authority and position.

The problem with attribution is that coauthors may come together in many types of institutional arrangements—and an even larger number of combinations of talents and efforts. The authors may be peers and truly partners in all phases of the work, or a mentor who supplies idea and guidance and a protege who executes the work, or a protege who initiates the project and carries it out