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AUTHOR Brearley, Neil
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ABSTRACT

During the past 30 years the technical report has developed into an important primary medium of communication in science and technology, to the extent that it is sometimes seen as a threat to primary journal publication. At the same time the (unclassified) report has been accused of not meeting the same standards of authority, scientific rigor, and retrievability as conventional journal publication. Report publication was reviewed in the light of standards commonly accepted for journal publication, and the inherent characteristcs of technical reports were assessed. It was concluded that both reports and scientific journals have distinct roles to play in the communication of scientific and technical information, and that a cost-effective system will make full use of the strengths of both. (Author/PF)

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The Role of Technical Reports in Scientific and Technical Communication

NEIL BREARLEY

Abstract—During the past 30 years the technical report has developed into an important primary medium of communication in science and technology, to the extent that it is sometimes seen as a threat to primary journal publication. At the same time the (unclassified) report has been accused of not meeting the same standards of authority, scientific rigor, and retrievability as conventional journal publication. Report publication is reviewed in the light of standards commonly accepted for journal publication, and the inherent characteristics of technical reports are assessed. It is concluded that both reports and scientific journals have distinct roles to play in the communication of scientific and technical information, and that a cost-effective system will make full use of the strengths of both.

I. INTRODUCTION

PERIODICALLY, comment in the "established" literature centers on the technical report and its place in the information stream. Generally, the tendency is to assert that reports have little if any legitimacy, and that they should preferably be ignored, or at best tolerated until the data can be published elsewhere. Skolnik, for example, in an editorial in the *Journal of Chemical Documentation* [1] notes that in a certain book, of 216 references cited he

> "... found somewhat disconcerting references to 65 reports and 32 meeting papers. These constitute a body of literature considerably less accessible to the average person than the journal or book (11 references) literature. Furthermore, the information in a number of these 97 references duplicates that in the journal references. ..."

On the other hand, as an editorial in *Nature* [2] said, "Over the years, it has become painfully apparent that the writing of technical reports has been one of the most rapidly growing components of the scientific enterprise. ... Some of these are humdrum documents, reviews of the literature in some narrow field, reports on particular experiments or calculations more suitable for the backs of envelopes than for the solemn stationary in which they are distributed. Some, however, turn out to be important and distinguished contributions to understanding, and the question arises how these are eventually to form part of the scientific literature. Those responsible for learned and scientific journals are increasingly aware of one important aspect of the problem, for there is what seems to be a growing stream of complaints from the authors of technical reports that their priority for some new idea or experiment has been stolen by the author of an article in the more familiar scientific literature. Nobody suggests that plagiarism has run riot, but there is no doubt that the publication of original results or ideas in technical reports is a professional hazard for many scientists."

These samples of editorial comment summarize many of the factors, pro and con, that arise whenever technical reports are discussed in the context of information transfer. But basic to any discussion must be the realization that technical reports exist, that they obviously fill a need that is not being satisfied adequately by other types of publication and, given the support they receive both from research workers and the agencies that are the source of funding, that they are not going to go away overnight. It is appropriate, therefore, to review their characteristics and to see how they interact with other primary publications media.

II. REPORTS AS PRIMARY PUBLICATIONS

Technical reports and journals are two of the principal media for primary communication in science and technology. The properties and problems of primary journal publication have been adequately ventilated (see, for example, the complementary views expressed by Herschman [3] and Wooster [4]), and it is not necessary to do more than summarize their main features.

Scientific journals have been in existence for more than 300 years, in which time they have served the scientific community by providing a system for open, formal, and orderly communication among scientists. In this sense, *open* means that the journals are freely available to anyone who pays the subscription or has access to a library, *formal* means that the journals are part of the scientific archive and that an accepted convention (the bibliographic description) permits unambiguous reference to be made to any given paper, thus permitting its retrieval by any interested person, and *orderly* means that the system is operated by scientists for scientists, and that papers are subjected to some form of screening or review prior to publication [5]. Journal publication also enables individuals to establish claims to priority in scientific discovery, and a respectable list of papers published is an essential part of a scientist's *amour propre*. In this respect particularly scientists are often equivocal. The scientist as a producer of information is naturally interested in seeing his work published in a prestigious journal, the scientist as a user of information is much less concerned with the way in which it is presented.

How does the technical report measure up to the standards of primary journal publication, i.e., continuity and connection with previous work, discipline, and rigor, set out above? Although technical reports are commonly supposed to be an outgrowth of government-sponsored research and development during and following World War II, they may be considered to have a much older origin. In one sense they pre-date scientific journals, since scientists were exchanging reports with one another long before sci-

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The author is with the Science and Engineering Library, Carleton University, Ottawa, Canada.

entific communication was institutionalized. For example, Copernicus (the five hundredth anniversary of whose birth is celebrated this year) circulated a preliminary draft of his new cosmology among selected specialists two decades prior to publishing his *De revolutionibus orbium caelestium* in 1543 [6].

The present discussion, however, will be limited to the unclassified technical report as it has developed over the past 30 years or so, and which has been defined by the U.S. Defense Documentation Center [7] as follows:

> "A report concerning the results of a scientific investigation or a technical development, test or evaluation, presented in a form suitable for dissemination to the technological community. The technical report is usually more detailed than an article or paper appearing in a journal or presented at a meeting. It will normally contain sufficient data to enable the qualified reader to evaluate the investigative process of the original research and development."

Are reports part of the open literature? The preceding definition includes the words "suitable for dissemination to the technological community" that would seem to answer this question in the affirmative. Many governments now have agencies, such as the U.S. National Technical Information Service (NTIS), charged with publicizing and disseminating reports generated as a result of government-sponsored research. Subscribers to the NTIS *Fast Announcements* receive regular notification of a selection of the more timely and pertinent (and salable?) reports in several subject categories, and NTIS publishes semimonthly a comprehensive listing (*Government Reports Announcements*) of reports in 22 subject categories in science, engineering, agriculture, medicine, and the social sciences. It is apparent, therefore, that the authorities concerned are anxious that reports should be made widely available provided that considerations of national security are not involved.

It is also clear that a report that has been described in one of the indexing and abstracting media may subsequently be referred to in an unambiguous manner. Most agencies sponsoring research publish style manuals which specify in some detail the bibliographic information to be presented on the front cover, and practically all reports are given a (hopefully unique) serial number of some sort. Although the uninitiated may find the system confusing (as may someone coming across *Jad. Energ.* or *Tr. Kaz. Nauch.-Issled. Inst. Zashch. Rast.* for the first time), those regularly using reports quickly become familiar with the prefixes. Further cross-agency standardization, both of format and bibliographical elements, should result when the American National Standard for Scientific and Technical Reports [8] is issued in final form.

It is on the question of refereeing that reports differ most widely from the journal literature. Few reports are subjected to the sort of outside scrutiny that a contribution to a scientific journal would receive. That this is so is inherent in the characteristics of the report literature, listed by the National Academy of Sciences-National Academy of Engineering Committee on Scientific and Technical Communication [9] as follows:

(1) it is written for an individual or organization that has the right to require such reports;
(2) it is basically a stewardship report to some agency that has funded the research being reported;
(3) it permits prompt dissemination of data and results on a typically flexible distribution basis;
(4) it can recount the total research story, including exhaustive exposition, detailed tables, ample illustrations, and full discussion of unsuccessful approaches.

It should be remembered, however, that although the report itself is not refereed, the *work* reported has often been subjected to initial and ongoing scrutiny. Granting agencies usually award funds on the basis of what is termed the "peer review" system. A proposal describing the proposed research is evaluated by an advisory panel (generally including "outside" members), the potential ability of the investigators to perform the work satisfactorily is taken into consideration, as is their performance on previous projects. The report resulting from the work has, in a sense, been pre-screened and therefore cannot exactly be likened to a manuscript received by a journal editor which deals with work outside his own specialty and which is written by an author whose name is unfamiliar. This is not to say that all reports have scientific merit (any more than all journal articles have) but to point out that comments regarding review procedures for reports may not deserve all the weight they sometimes receive.

Unfortunately, however, many reports are written not because a certain piece of work has reached its culmination but because an arbitrary period of time (usually established by the funding agency) has elapsed. Thus there is a plethora of "Quarterly Progress Reports" and similar documents which undoubtedly constitute a great deal of noise in this particular communications channel. In the absence of some form of quality control to differentiate between reports of substance and the merely administrative reports, any report collection will probably become cluttered with a mass of meretricious material, to the frustration of both users and those responsible for organizing and maintaining it. Also, it would be impossible for an individual to scan the report literature with the aim of keeping himself informed of current developments, in the manner, for instance, that one can scan the contents page of a regular journal.

It might be asked why, if adequate formal means of scientific communication exist, do reports continue to multiply? The following advantages of this means of communication have been advanced in the past: greater speed of publication, because of the absence of refereeing procedures and because reports are usually produced by offset lithography using plates made from the typed manuscript; greater flexibility, because the format can be more easily adapted to different types of material and limitations on length can be more relaxed; greater detail can be included, such as experimental procedures, all the results of observations rather than summaries, negative results, and speculations; workers in new and interdisciplinary areas may prefer to communicate by report either because no established journal serves them or because the field is so diffuse that relevant work is dispersed in a great many journals.

In summary, the report literature is user directed in that the decision regarding what, when, and to whom to communicate rests almost entirely with the individuals involved.

III. THE JOURNAL-REPORT RELATIONSHIP

As Garvey *et al.* [10] point out, communication in the physical sciences first flows through the informal channel and then, perhaps after some modification, through the formal channel. The pattern of information dissemination is almost perfectly logical, beginning with the most specific audience (in-house colloquia, internal reports, and preprints) and proceeding to the most general audience (national meetings, technical reports, and journals). Journal editors have expressed concern that the continued proliferation of reports represents a threat to their own survival. That this can hardly have been so in the past is evident from the available statistics, both of the increase in the number of pages published annually by the established journals and of the number of new journals coming into existence.

Koch [11] refers to reports as being "quasi-published" and this idea is reflected in the ambivalent attitude towards reports taken by many journal editors. It is a common charge [5] that much work originally published in report form is subsequently republished in a journal. The practice, widespread in some fields, of disseminating preprints has not improved matters. Some journal editors, therefore, will refuse to accept papers whose substance has appeared in a report on the grounds of prior publication. On the other hand, the same journal editors will refuse to allow authors to make reference to reports on the grounds that they are not generally available, and require such references to be made to "unpublished work" or "private communication," both of which are equally unsatisfactory and much more obscure than a report citation.

The complex interrelationships between technical reports and scientific journals may be brought into focus by considering two extreme approaches [12]. The first approach would recognize the scientific journal as the preferred communication medium for all scientific and technical information. It would require sponsors of research actively to encourage research workers to submit results to the journals for review and publication, and would restrict report writing to the minimum necessary for project management. Obviously, the amount of material submitted to the journals would increase substantially, and the publishers would probably have to be granted some form of subsidy to help them expeditiously to handle the volume of material which would result. The increased load on the journals would also be felt by abstracting and indexing services, and by review publications. Presumably, papers that incorporated lengthy compilations of data could be published in outline only with the data deposited in an auxiliary publication system for retrieval on demand.

The second approach would designate technical reports as the preferred medium for detailed scientific and technical communication. If this were followed there would be a much greater involvement of the sponsoring agencies in all areas of scientific publication, primary, secondary, and tertiary, and in information retrieval. There would be a corresponding decline in the influence of the journals, papers published in-house would not be exposed to the same critical appraisal that results from open publication in a primary scientific journal, authors would not receive peer recognition to the same extent, and there would be a real danger of science as a whole becoming compartmentalized.

Clearly, neither alternative is wholly tenable, or even desirable, and journals and reports are likely to continue to coexist in the future as in the past. The continued growth and development of all forms of communication media requires that each be used efficiently for the purpose for which it is uniquely fitted. For the journals, in whatever form publication takes, this will continue to be the open, formal, and orderly communication of research results. Reports, in addition to their role as contractual documents, should continue to be used to serve that section of the scientific community that needs complete, detailed, and up-to-date information in some well-defined subject area. Some journal editors could do themselves a service by developing a more liberal attitude towards the report literature, by not disallowing publication of a paper based on a report on the grounds of prior publication, and by permitting authors to make reference to open reports distributed through agencies such as NTIS. Sponsoring agencies could help increase the confidence that journal editors place in reports by insisting on more rigorous reviewing procedures.

IV. CONCLUSION

Both technical reports and journals have their own distinct roles to play in the communication of scientific and technical information. A proper understanding of the unique features of both formats will lead to their more effective utilization. It may be noted that if certain present trends in journal publishing, such as the distribution of papers as separates and reproduction of current archival journals in microform, continue then the journals will more and more take on the external attributes of the report format. In that event, authors, editors, publishers, and libraries could well profit from a study of the ways in which the report has developed as a communications medium.

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