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# Technical Information—Too Much or Too Little?

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IT has become the custom in recent years to open most discussions of technical information and technical communications on a rather ominous note. As a rule, we are told at the onset that we are faced with an overwhelming problem, that there is too much information being produced, and that we are no longer able to cope with it.

If only to dispel for a brief moment the gray monotony of gloom which seems to overshadow these discussions, I should like to begin by saying that there is, if anything, a shortage of useful technical information in the world today. This thought is based on the observations that the existence of a ton of paper does not necessarily connote the existence of a ton of information and that what may be significant information to one man may be useless verbiage to another.

Related to the foregoing observations is the fact that what may have been useful information last year may be meaningless or useless information this year. People often talk nowadays about making use of the written record of human experience, but they often forget that this record, in science and technology especially, is very ephemeral; it loses its significance and becomes obsolete very rapidly. It has to be used within relatively few years if it is to be used at all.

## Sources of Complaint

Just as it has become customary to open up discussions of technical information and communication on a note of sadness, it has been customary to document this sadness with an array of ominous statistics. Most of these statistics will be familiar to readers of this article. There are, for instance, the statistics that in 1950 there were something like 50,000 serial publications in science and technology, and that these publications were at that time producing about 1,850,000 articles and papers a year. Another statistic that has enjoyed great currency in recent years is that we in this country are producing about 150,000 unpublished research reports annually in connection with government-sponsored research. But the most startling statistic of all is that our great libraries are doubling in size every 16 years. I assume that this statistic is startling because I have seen it repeated in any number of papers that I have read in the past couple of years.

Actually, these statistics are very much like the "fillers" that newspapers frequently tuck away in their pages. They are vaguely interesting and perhaps impressive when we read them; they help us to pass the time and to forget momentarily our day-to-day worries; but they do not help us to define or solve very many practical problems.

It is interesting that when we analyze the sources of the complaints about the growth of the literature they seem to come primarily from two groups: the pure or academic scientists, who happen to be the greatest and most effective users of the literature; and the librarians and "documentalists," who are the organizers and disseminators of the literature.

The complaint of the pure scientist seems to center around the fact that too much material is being published in the journals he reads, and that, in order to compress as many papers as possible into each issue of each journal, the average paper is shortened to the point where it becomes practically meaningless. I encountered this complaint very frequently in an interview survey of the scientists of

Johns Hopkins University (*1*). It is a very valid one. Our scientific journals are not giving enough heed to the growth of our scientist population or to the increasing degree of specialization among our scientists. They persist in making one journal do the work of several, and in doing so they very often fail to produce even a single journal that covers adequately the field it is supposed to cover.

In this era of scientific growth and specialization, it is becoming more and more difficult to maintain a single *Journal of the American Chemical Society* or *Physical Review* that can actually do justice to the vast reaches of pure chemistry or pure physics. It is becoming increasingly obvious that if such journals are to serve their intended functions, they will have to be divided into a number of specialized, limited-circulation publications. In this regard, Goudsmit (*2*), writing as editor of the *Physical Review,* has suggested the need for two discrete journals to replace the burgeoning *Physical Review.*

The problem of rising costs resulting from the issuance of several publications in place of one can probably be remedied through smaller print orders and the use of offset or other near-print methods in place of letter press. Pure scientists are less interested in the physical appearance of the publications they read than they are in the ideas they convey. One of the fundamental problems that the pure scientist now faces is that the average paper he reads does not convey enough meaningful information. And so, while many people feel that there is too much information around, the pure scientist is suffering from a real shortage of information.

As might be expected, the cause of complaint among librarians and documentalists is somewhat different from that of working scientists. It has become fashionable in recent years for librarians and documentalists, as the guardians, organizers, and disseminators of the collected written record, to build "straw men" and to point to the tremendous growth of the magnitude and significance of their activities. But if our libraries are in fact doubling every 16 years, a large proportion of the blame must be borne by the library profession.

We librarians and documentalists are rather like the legendary Texas oil millionaire who trades in his Cadillac every time its ash-trays become full. We seem to like to fill up buildings as rapidly as possible and to trade them in for new buildings. The ironic difference between librarians and Texas oil millionaires is that librarians cannot afford Cadillacs, so they go after multimillion dollar buildings instead; and Texas oil millionaires, who are in a position to finance new libraries, are much more interested in new Cadillacs. It would be nice if we could induce some Texas millionaires into the library profession. However, this would probably result in bigger and better library buildings, but it would not alter the sad fact that our research libraries are becoming intellectual graveyards. Librarians must exercise a greater measure of discretion in selecting the materials they add to their libraries and retain in them if they wish to execute their guardianship effectively.

To defend the documentalist against the unfair charge that he is a coconspirator with the librarian in glutting old libraries and building new ones to replace them, it should be pointed out that the documentalist, faced with an overflowing library building, would not attempt to replace it with a new building; his first instinct would be to index or classify its burgeoning collections. The documentalist would probably substitute a multimillion dollar information-retrieval system for the multimillion dollar building of the librarian. This is possibly what differentiates the documentalist from the librarian.

## Growth and Use

It is not surprising, when we consider our national statistics, that our supply of technical information has grown; everything else has. During the past 15 years, our national dollar income has more than quadrupled; the number of scientists and engineers in the United States has more than doubled; and the number of scientific and technical students in our colleges and universities has also more than doubled. Our national research budget is more than 6 times as large as it was in 1940.

During this period of expansion, our total population has increased only 25 percent, indicating that a greater and greater proportion of us are becoming engaged in scientific pursuits. If anything, the growth of our scientific literature and information is lagging.

In the course of gathering the foregoing statistics, I happened upon an article in the *New York Times* in which it was shown that the number of telephones per person in the United States has doubled in the past 15 years. Does this mean that the average person has to use twice as many telephones as he did in 1940? Of course not. It simply means that more people are finding more reasons for using telephones than they did 15 years ago. The same is true of technical information.

One of the things that increases the quantity of technical information, and the need for it, is the diversity of purpose for which it is used. A given piece of technical infomation generally means different things to different persons. The vehicles by which people receive information vary, and the form and intellectual level in which they are able to assimilate it also vary.

An item of technical information, presented in a form that is meaningful to the untrained layman, may seem trivial and redundant to the trained specialist. If it is significant, the trained specialist will probably have read about it already in the technical literature. This same information, written for the trained specialist, may have little or no meaning to the layman, and, if it is to be made meaningful and useful to him, it must be interpreted.

It is this variety in the form and intellectual level in which technical information can be assimilated—this need for interpretation and adaptation—that increases the total amount of technical information which must be produced, if the greatest possible benefit is to be derived from new developments in science and technology.

### Need for Market Research

The varying significance and the diverse applications of technical information create a fundamental need for market research to guide its production, storage, and dissemination. Commercial publishers have for many years appreciated the significance of market research. They have depended on market research because they cannot afford to gamble. They have to know that there is an audience for the publications they are producing and distributing; and they have to know the form and content of the information that is most likely to capture and retain this audience. This is a matter of economic survival for the commercial publisher.

Although there are a few exceptions, such as Gray's study of *Physics Abstracts* (*3*), Glass's study of *Biological Abstracts* (*4*), and the recent pilot study done for the National Association of Science Writers to provide information for making science writing and scientific publications more useful (*5*), learned society publishers, contractors who write reports to satisfy the requirements of their contracts, and other information disseminators whose activities are subsidized, do not as a rule make practical use of market research. This can, of course, be attributed to the fact that their livelihoods do not depend directly on audience approval. This is what gives rise to the complaints of scientists that papers are getting so short as to be useless, and this is what gives rise to many other complaints about the way that scientific information is published and disseminated.

It is this failure to recognize and utilize market research that is making libraries and other collections of written and published technical information difficult to use. Instead of complaining about how big our libraries are getting, we should investigate how these libraries are being used, what parts of our growing collections are useful, and what parts are a waste of shelf space.

Like other forms of refuse, stale information is not only wasteful of space, but it can be "toxic." As Philip Morse (*6*) has pointed out in a recent paper on the use of operations research in physics libraries, things in physics that were written 25 years ago are worse than out of date—they are often erroneous. Science grows and matures, as does everything else.

There have been numerous studies of how much time elapses before technical publications fall into disuse, and all of these studies have shown the active life of the average publication in science to be surprisingly short. Fussler (*7*), in a study of the literature references cited by authors in chemistry and physics, has demonstrated that the bulk of such references are less than 10 years old. Hanson (*8*) equated library storage costs and the use that is made of the periodicals in the library of the British Scientific Instrument Research Association. In doing so, he found that the use of periodicals over 13 years old is so slight as to warrant discarding them and borrowing such publications from central depository libraries when the rare need arises. Goudsmit (*2*) has suggested that with the rapid development of physics, it is futile for a physicist to keep more than about six shelf feet of the *Physical Review* as a back collection. Six feet of *Physical Review* now goes back about 5 years. In my own study (*1*), I found that more than 50 percent of the periodicals used by working scientists are less than 5 years old and that, for most purposes in the population studied, a run of periodicals going back 15 years would cover all but a very small fraction of the journals required.

Morse (*6*) has shown in his paper that a five-volume textbook on acoustics, written in 1880, can now be replaced by a single chapter that will omit nothing that was in the five original volumes and that will contain a good deal that was not there. Hutchisson (*9*) has attributed this to the fact that knowledge in the physical sciences is what he terms "accumulative": constant checking, revision, and simplification make previously published works in a field obsolete and reducible to simple, compact presentations in textbook form. And even textbooks become obsolete rather quickly. Buddington (*10*) has shown that the rate of obsolescence of engineering books is about 16 percent a year.

Many librarians and working scientists will voice objections to what they consider the arbitrary limitation of the published materials that are to be stored in libraries. However, if this limitation is based on careful analyses of the actual use that is made of the publications in a library, it can hardly be called arbitrary. If anything, the librarians and scientists who insist on retaining publications in sorely taxed libraries, regardless of whether they are used, are the ones who are being arbitrary.

A basic purpose of market research in dissemination of technical information is to define as accurately as possible the extent and manner of use of a given vehicle of information. These factors will vary from field to field and from publication to publication within a field. However, the temporal value of scientific publications is finite. If the last 20 or 30 years of a given periodical are all that are ever used by the clients of a library, it is an obvious waste to insist on retaining a back run of 40 to 50 years.

## Significance of Vehicles of Information

In addition to telling the librarian how long to store the published materials in his custody, market research can furnish him some broad hints about what materials to acquire in the first place. Bradford (*11*) found in studying publications in two fields of science that the bulk of the information on these subjects was contained in a relatively few journals. In one field, 68 journals were found to contain 928 papers on the subject in question; an additional 258 related publications contained only 404 articles. In the other field, 37 journals produced 243 papers, while 127 related journals produced only 152 references. From these figures, it becomes obvious that the cost of trying to have all the available published information on a subject in a single library is likely to be prohibitively great, but that the cost of maintaining most of the available information in a given field is likely to be economically feasible.

It behooves the librarian to ascertain the subject interests of his clientele and to seek out and have in his collection the most productive sources of information in these subjects. This can be done by studying the literature, but probably the best way to do it is by analyzing the publications actually used by a cross-section of the library's clientele. There are sometimes subtle reasons why one publication which publishes no more papers in a given field than several others may be consulted more frequently than the others. The librarian would be wise to look to the scientist reader to find out which are the most useful sources of information in a given field.

Similarly, documentalists, publishers, editors, and other persons concerned with the broader aspects of the dissemination of technical information, in order to do a meaningful job, should ascertain the most effective vehicles for reaching their audiences. For a publication that is already in existence, the publisher would do well to study his audience from time to time to find out how his publication is being used and why it is used the way it is. Such market research will, in most cases, form a basis for needed improvements if the results are accurately applied.

In the case of a contemplated publication, the opportunities are even greater. An understanding of the character, needs, and information-gathering habits of the contemplated audience can often spell the difference between the real success or failure of a new publication. The word *real* is used here advisedly. For a commercially produced publication, the test of real success or failure is very simple. If enough people purchase and read the commercially published publication, and if enough advertisers consider this audience a potential market, the publication is a success. If, on the other hand, revenues from subscriptions, newsstand sales, and advertising add up to an amount that is less than the total cost of producing the publication, it is a failure. It may, of course, be a cultural success, but if there is not a corresponding fiscal success, it will be forced to cease publication or find some form of subsidization.

The subsidized publication need not, and perhaps cannot, apply this simple test. Noncommercial publication projects worthy of subsidization are generally chosen and directed by boards or committees of notables who can hardly be called representative of the market. The subsidized publication, in order to perpetuate its subsidy, has only to please the small group controlling the purse strings. This is a much simpler target to focus on than a widespread audience of readers or seekers of information. However, it is not the group for which the publication is presumably designed. The person who spells the real success or failure of any undertaking in the field of information dissemination is the consumer. He is the person who must be understood and satisfied. Unlike its commercial counterpart, the subsidized publication can enjoy financial success and actually be a miserable failure.

Mention has already been made of three projects, by Gray (*3*), and Glass (*4*), and by the National Association of Science Writers (*5*), which illustrate the use of market research in the improvement of scientific publications. I should like also to make brief mention of another market research project that a number of nations, including the United States, are participating in at the present time. This project is being sponsored by the European Productivity Agency, which is an outgrowth of the Marshall Plan in Europe. The purpose of the project, which is being carried on through interview surveys in eight countries, is to foster the use of technical information by small- and medium-sized firms in Europe, and, in so doing, to increase the productivity of these firms. The United States, with its proved capacity for production, is serving as a control in the study.

The plan of the survey is quite practical. Instead of spending its limited funds trying out a bunch of devices that might or might not get information to the man who can use it, the European Productivity Agency is trying to find out how this man is now getting whatever information he uses. This will provide a tested route by which he can be reached. And when he is reached, he will not be snowed under with a bunch of technical jargon that he cannot understand and apply. He will get his facts in his own language, and on his own level of learning.

The European Productivity Agency survey is based on two simple premises. The first is that in order to be useful, information, regardless of its form, must be easily understood and easily applied by the consumer for whom it is intended. The second premise, which follows naturally on the first, is that it is much easier, and much better, to design the product to satisfy the consumer than it is to try to alter the consumer to meet the requirements of the product. You can index a book or a paper, or a collection of books or papers, from now until doomsday, but if it does not contain information that is interesting and readily understood by the people who can use it, it will not be used.

## Conclusion

I should like to make a plea for a bit of enterprise, preferably free enterprise, in the communication of technical information. It would be good if all of us who are involved in the business of writing and editing and storing and disseminating information would try to evaluate realistically the needs and problems of the people we are supposed to be serving. No matter what we do to improve man and his lot, the average man lives a life of preoccupation with his day-to-day problems. He will not put himself out, if he can help it, to learn about new developments. The new developments have to be presented to him through his normal media of communication. We have to find out what these media are if we are to do him the greatest good.

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*Although Experiment is an instrument of immense importance, it is one which derives all its value from the mind directing it. Used at haphazard, its results are fortuitous. The example of the alchemists should teach us how little it effects in incompetent hands; that example discloses experimental investigations wandering into paths more eccentric, and arriving at conclusions more preposterous than ever seduced an ARISTOTLE or an ARCHIMEDES. Experiment is an art, and demands an artist*—George Henry Lewes, *Aristotle: a Chapter from the History of Science* (Smith, Elder and Co., London, 1864).