By RALPH R. SHAW

Publication and Distribution of Scientific Literature

PUBLICATION IS A TERM that has never adequately been defined. In some areas of science, such as taxonomy, "first publication" is a very important concept —and a fuzzy one. In other areas its definition affects the work of scientists in many ways.

In essence, publication or publishing includes a complex, integrated series of mechanical and intellectual processes involved in the selection, reproduction and dissemination of manuscript material. These processes are inter-related and it is not helpful to concentrate unduly on any one of them.

As indicated in a recent editorial in *Science*,[1] this writer sees no insoluble problems in the publication of scientific literature or other scholarly books. If they are important to mankind, then means for their publication can be found—and, in fact, generally are found. When we complain about the sad plight of scholarly publishing we may forget that somewhere between 100,000 and 1,000,000 scientific and technical books, articles, reports, and documents issued by governments are published annually.

It is in this respect, however, that we must make sure that we understand what we are talking about when we use the word publication; and scientists may have to do some re-thinking in this regard if they themselves are not to place undue restrictions on dissemination of scientific information. Fine printing, desirable though it is, is not an absolute requisite for publication. Movable type is not requisite for publication. All that is required is that the manuscript be *selected for publication,* that it be *duplicated,* in some form, in numbers sufficient to make it normally available to those who want it, and that it be *distributed.* Thus, the restriction imposed by international rules on nomenclature, which at least until recently did not recognize as published anything issued in microfilm, mimeographed or similar forms, regardless of the number of copies produced and distributed, is a good example of the restriction upon publication caused by insistence upon a form of publication that is uneconomical for some types of material.

It was some time before the writer realized that when a United States government information officer refers to "government publications," he is talking about those few printed from movable type at the Government Printing Office in Washington, not even including those printed from movable type at field printing stations. Thus, the United States Department of Agriculture, for example, issues a *Monthly List of Publications,* which normally displays some twenty-five titles per month. When all the items separately issued by this department are counted, however, the total is eight or ten times that number, and the user who relies on this so-called monthly list of publications to find out what the USDA has issued in his field is badly misled.

Without multiplying these examples further, it appears quite evident that there is need for clarification of the concept of publication in the interest of the advancement of science.

The forms in which scientific information may commonly be published, here referring to textual forms, are the book

[1] R. R. Shaw, "Publishing Scientific Books," *Science* CXXI (1955), 17A.

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and the "paper," with the latter divided into forms such as the congress or periodical article, the pamphlet, and the "report." Although there is no invariably sound intellectual reason why it should be so, the order given above is quite commonly considered hierarchical in terms of the significance of the publication, and, perhaps because of this stereotype, this order of levels of what might be termed dignity-value is justifiable more frequently than not. Who does not take the task of writing a book more seriously than the task of writing a symposium paper or a report of an experiment? On the other hand, the "paper" is by far the more common and speedier method of publication.

In terms of the quality of selection, we normally find a relatively high order of scholarly competence applied to the selection of books and scholarly periodical articles for publication. This is not invariably true, however, and a self-published book or a subsidized book may well have been judged by somewhat different criteria than are applied by a scientific journal which uses a sophisticated refereeing system. Report literature, in the sense in which it is commonly used at present, varies from a slightly sophisticated form of laboratory notebook, required for liaison among a team of researchers in fifty places under fifty contractors, to highly polished, critically selected, carefully edited monographs.

Selection thus varies with the type of publication that is intended to result, with who is paying for it, with the type of use—and, inevitably, in varying degrees, with the quality of refereeing.

Be that as it may; a large percentage of the books that do not get published do not get published because they are not worth publishing—at least in the judgment of those who do the refereeing. This has probably always been true, and the fact that it is relatively easy for a prospective publisher to return a book with a reference to limited market or other polite circumlocution tends to distort the proportion of allegedly important books that are unpublishable. And, of course, there may always be cases in which the judgment of the best of referees with the best of intentions may be erroneous. Nevertheless, as a spare-time publisher in a small way, the writer can testify that a very large proportion of the manuscripts that reach him so obviously have little to commend them that they are rejected on that ground.

Except for the perennial quarrel about delay in publication, and "promptness" which has never been defined in very meaningful terms, there is relatively little difficulty about publishing periodical articles that meet exacting literary and scientific standards. An unpublished survey of a considerable part of the field of science by the National Science Foundation in 1954 found no evidence that existent journals could not publish the worthwhile material that was submitted to them; and approximately the same conclusion was reached by the National Research Council's conference on scientific publishing about two years earlier. So far as periodical publication is concerned the problems appear to be concentrated about the questions of acceptable length of papers and such highly controversial subjects as the growing tendency to charge the author (or his employer) for part or all of the cost of publication.

There appears to be general agreement that insofar as there is serious difficulty about publishing in the sciences it centers about the publication of books. However, a recent spot check undertaken by the American Council of Learned Societies has not indicated that there is any overwhelming number of first-rate unpublishable manuscripts (in the humanities at least) despite the frequency and warmth with which the difficulties of publishing in this field are discussed.

Costs of Publication

Insofar as there are real difficulties in publishing important scientific and other

scholarly books, these difficulties revolve around the seminal book of limited market.

The critical factor in this area is the size of the edition that can be marketed efficiently. The most suitable production process does vary with the type of material involved, with the amount of tabular, notational, pictorial, and pictogram material that must be set. If this were the critical factor, then a simple solution in chemistry, for example, would be to adopt a new notational system such as that of Dyson or Wiswesser, or others, which would bring chemical typesetting into the range of cost of normal typesetting. And while that would be unconventional, this writer would state as a matter of faith that while conventional printed form is preferable, it is not preferable to the point of making publication impossible; the only thing we can not afford, whether it be in terms of cash cost or permissible change in our habits, is to have important contributions unavailable.

However, composition cost is only a small part of the total cost. In the case of periodicals of relatively large circulation the manufacturing cost may run around 50 per cent of the retail price. In the case of books, particularly scholarly books published in small editions, the manufacturing cost is usually only about one-fourth of the retail price, and the composition cost is only about 40 per cent of the manufacturing cost. In chemical works involving large numbers of structural formulae, the composition cost may be considerably more than 40 per cent of the manufacturing cost, but even if it were 60 per cent of the manufacturing cost, that would still be only of the order of 15 per cent of the retail price. Also, the cost of composition is important only in the fact that it is a relatively inflexible cost and is the same for any given type of composition, whether 100 copies are produced or 10,000 or more. Thus the cost of composition per copy must always be divided by the number of copies that will be distributed, and a costly and beautiful method, such as monotype or even handsetting, which would be prohibitive if divided up among 500 copies, is negligible when divided among 10,000 copies. This indicates, again, that the probable distribution is the critical factor in determining the economically feasible methods for producing books of any type, and it is of particular importance for scholarly books, which in chemistry or other fields never reach the volume of distribution of best-selling novels.

There is no problem in producing and marketing a book in chemistry that will sell 10,000 or more copies—the problem is that there are not very many books in this field that will do that. In that range, even if monotype composition cost $25 per page (and it does not), it would not appreciably affect the cost of the book—even in a 400-page book, composition would represent only one dollar per copy, which would not be an undue proportion of the cost of a scientific book of that size. On the other hand, a cost of half as much per page applied to 1,000 copies of this hypothetical 400-page book of formulae would make the composition cost alone about five dollars per copy, which would mean that the book could not be produced unless some method other than monotype composition were used. If we go down to 500 copies, which is the range of the market of many scholarly and scientific works, then even if the cost of composition were halved again or even divided by four, monotype would be uneconomical. These figures are not meant to imply typical conditions, but rather to emphasize the relationship of the size of edition to the design of the book, regardless of the actual cost of composition per page, which will vary from country to country and from area to area within some countries.

But, as has been noted, costs other than manufacturing account for about three-fourths of the retail price of the average scholarly book, and for more than that

in the case of trade books. Recognizing that discussion of bookkeeping is always parlous, it is nevertheless essential that this general order of relationship of manufacturing cost to selling cost be understood if we are to ensure unsubsidized publication of scientific books of limited market. This problem, like that of composition cost, would take care of itself if we could be sure of selling a large enough number of copies. However, to sell books in large quantities requires the cooperation and active work of the bookseller and he must be paid in proportion to the amount of effort and time he has to spend. This means that scientific books would have to carry higher discounts to the bookseller than do trade books, instead of the much lower discounts they now offer. This would raise costs, which would in turn further increase the size of edition that would have to be sold to break even, and that would in turn further increase the necessary cost of advertising, sales effort, and so on ad infinitum.

Unfortunately, unlike that of many other products, the market of the scientific book is not only generally small, it is relatively inflexible, and efforts to push sales much beyond the normal group of interested specialists and libraries that serve them has in the past merely increased losses by raising the break-even point to a higher level than the market will absorb.

The alternatives that are available are: (1) to raise prices; (2) to subsidize the books and periodicals essential to the advancement of science; and (3) to reduce production *and distribution* costs.

As indicated before, there is obviously no problem involved in publishing scientific books that will sell 8,000 copies or 10,000 or more. We have a large and efficient technical book publishing industry that can handle these.

The book that will sell 2,500 or more copies, and that cannot be handled by the book trade, can generally be published without subsidy by university presses.

The book that sells less than 2,500 copies is the one that concerns us here. Lest we think that that is a small proportion of the total, it should be noted that the director of the University of Illinois Press, who should be in position to know, reported in the *Bulletin of American Association of University Professors* in 1953 that three-quarters of the books published by university presses are subsidized. Even more important than the number of books that cannot be published without subsidy is their quality, since those books which advance the frontiers of science are generally of interest to relatively few and their importance to society cannot be judged by their potential market.

The first alternative, i.e., increasing the prices above those conventionally charged for trade books, is not new. Springer-Verlag, among others, has long charged considerably more for its books than we have been accustomed to consider the going rate.

In fact, in some cases the prices, when translated through the mysteries of international book selling into dollars, come to between seven and nine cents a page, i.e., from $15 to $20 for a 250-page book, as compared with one to one and a half cents per page for most trade publications. There is danger in this alternative, since it, like the second alternative, tends to subsidize wastefulness in a field in which we cannot afford waste. If raising the price alone is relied upon then the seminal book may be priced so high that even the two or three or five hundred scholars who must have it cannot afford to obtain it. It does seem reasonable to assume that the price for scholarly books in the sciences has to be adjusted to the potential market. A textbook which can be expected to sell 10,000 copies over a period of three or four years can be priced fairly close to the going rate of trade books. On the other hand the book de-

signed for a market of 500 copies will probably have to be priced at twice that rate. Even in the depth of the depression in the United States, when trade books were selling for one cent per page or less, according to Robert C. Binkley's fundamental study on methods of reproducing scholarly materials, scholarly books cost 2.1 cents per page. It does not seem unreasonable to price books in small editions at approximately twice the going rate for those in large editions. However, one now finds even such things as a symposium volume, published in 1955, in which the cost is reduced by the fact that no royalty need be paid to the authors, selling at the shocking price of $8.75 for a 270-page octavo book. This type of pricing, particularly since much of the text and illustrations is unnecessary and some of it is duplicative, could become an abuse which would probably further hamper the distribution of scientific books.

The question of pricing is one in which the public generally has fairly strong feelings. In the United States pricing of a book much above one cent per page makes everybody who receives it feel as though it is priced high, despite the fact that the wide variation in storage per page and size of page may make the actual storage content of a page vary by a factor of two or more. In this respect, general and scientific public opinion appears less responsible than that of most publishers who, having a monopoly of their product, could price realistically for books of low distribution and most generally do not do so because of the public stereotype of a penny per page. Recently, even novels have been bringing a penny and a half per page or more, and children's books, which commonly provide only forty or fifty or sixty pages of text have been priced at $1.50 to $2.50. The answer, therefore, so far as realistic pricing is concerned, is probably somewhat less timidity on the part of the publisher in pricing books at two or even two and a half cents per page, if that is necessary to bring them out in small editions. For reasons noted below, however, even that would not make the scientific book of limited market particularly attractive to most trade publishers.

The second alternative is subsidy, and this habit is growing rapidly, particularly with the development of so-called page rates in the periodical article field. Having stated that the only thing that we can not afford is to do without important contributions to knowledge, and agreeing with the Royal Society Scientific Information Conference finding that publication of research is an essential element of research, one cannot quarrel with the need for subsidizing publications when there is no other alternative. In general, however, the objection to subsidizing publications is the danger that we may merely be supporting wasteful methods. This forms a concealed tax upon our scientific research budgets, our scientific libraries, and on the public generally, which should be provided if essential for the good of mankind, but which could readily take over all scientific publishing, since it makes the publisher's task so much easier and lends itself to encouragement of inefficient production.

The third and by far the preferable method, probably in combination with the first, is to design production and distribution suitably for the type of book and its potential market. This means utilization when appropriate of letterpress, or offset reproduction from cold composition, or auxiliary publication, or reduced facsimile. Above all, it means design of the overhead of the operation and of the distribution system and costs of the operation suitable for the optimum dissemination of the particular book.

By and large, too much has been made of production or manufacturing cost. Not only does manufacturing cost constitute a small part of the total cost, but skill in design and skill in selection of sources of

supply may in many cases make what is generally considered the most expensive process the cheapest process. This is true because linotype machines depreciate every hour whether they are used or not and the cost differential between linotype and cold composition for straight text is so slight that it is easy to make cold composition done inefficiently cost more than linotype composition done efficiently, particularly if such composition is done as fill-in work when the machines would otherwise be idle.

It is practically invariably true that cold composition on the typewriter with justified right hand margins, requiring double typing, will cost more than linotype composition for straightforward work. While it is difficult to generalize for all labor and materials conditions under different pay scales in different countries, by and large, typewriter composition is useful primarily for difficult work such as bibliographies, mathematical and chemical material, and books heavily illustrated with halftones.

Bibliographic work whether done in linotype or in typewriter composition generally cannot have justified right hand margins, and suitable design, i.e., placing the item number on the right hand margin, can square off the right hand margin without double typing. Also, the setting of chemical formulae and mathematical equations on the monotype machine is essentially hand work in which both machine and operator are used relatively inefficiently. In cold composition these can frequently be drawn and pasted in at much lower cost than they can be done on the typecasting machine. Similarly halftone illustrations require expensive screened cuts in conventional printing; whereas the screening charge for the reproduction in offset is less than the cost of typing a page of text, so that they are actually cheaper to produce in offset than are text pages. The quality is somewhat lower in offset halftones, but reproduction quite satisfactory for most purposes can be obtained by fairly careful work.

While the new photographic typesetters, operating on the principle developed by both monotype and linotype, may eventually make it possible to make the composition part of the final typing of a manuscript, thus eliminating a large part of the work of composition, these tools are not yet available, and even they will not eliminate composition costs, since the composition typing would be more expensive than would straight typing, and there would still be the cost of running the tape through the photographic composing element to produce the reproduction copy in film. This might reduce the number of copies at which composition could reasonably be amortized, but it is doubtful that that would make a 100-copy edition economical. Thus, in cases in which it is not feasible economically to market as many as 300 to 500 copies (and possibly as few as 100 under newly developing technology) other forms of reproduction will be needed. The other alternatives that are available include the process known as "auxiliary publication," which was developed by Watson Davis in the American Documentation Institute; reduced facsimile editions, whether a 2-4 diameters or greater reduction ratios; and the single copy processes.

Auxiliary Publication

Auxiliary publication is an interesting combination of multiple copy production of an abstract of the article or book, tied in with a single-copy service for production of the whole of the original on demand.

One of the important features of this program is that the article is submitted to refereeing, and the journal will not publish the abstract unless the article meets its normal intellectual requirements, but is too long, too tabular, too profusely illustrated or the like to be printed in full.

This technique of auxiliary publica-

tion is not generally considered to constitute publication in the sense of priority of publication and thus has received little acceptance from scientists in the United States. The technique, however, has been applied on a very large scale in such operations as the post-war program for making enemy technical data available. Up to 10,000 articles a week were called for at the peak of this service, through the single-copying method based on the Office of Technical Services abstract journal.

Microprint and microcards are edition processes. The terms are not identical and they are increasingly confused. The microprint process, as developed by Alfred Boni, is an offset printing process. In this process the original is photographed on microfilm at about 20 diameter reduction. A hundred pages are laid up in film form and then burned into an offset plate and printed onto card stock. This provides for accurate indexing on a reading machine, with a hundred pages per sheet.

The microcard process, which was originally described by Goldschmidt and Otlet in the *Bulletin of the International Institute of Bibliography* almost fifty years ago, has lately come into active use. It consists of photographing the originals in microfilm, laying up strips of microfilm and then making contact prints on silver-halide coated cards. Since both of these processes require a rather large investment in preparation of the master copy, both require editions to amortize that cost and to bring it down to a reasonable level. The minimum economical edition for either is of the order of twenty to thirty copies and the minimum level at which they appear to cover all their costs is probably of the order of fifty copies. They do, however, provide a method for publishing scientific and technical books, reports, and articles in editions of less than a hundred copies. Applied within that field they are of real assistance. If applied to publications which have a greater potential audience they may actually limit the usefulness of the book, rather than broadening its availability, because the high reduction ratio restricts the use of the material to locations at which reading machines are available and to the number of machines available.

A third development in this general area is the sheet microfilm which has gone much further in Europe than it has in the United States. This may take the format of either the microprint or the microcard and has the considerable advantage that enlargement prints may be made from sheet microfilm just as from roll microfilm, while it is not feasible to make enlargement prints from microprint or microcards. Further development of sheet microfilm as a small edition process may be anticipated.

Among the single-copy processes microfilm and substantially full-size photographic copies are too well known to require thorough discussion. It should be noted, however, that in the case of reproduction of articles on demand there are hidden costs in the use of microfilm which are not always considered, and it may very well be that when we compute all the costs, including depreciation and costs of equipment for reading and the extra use time in using microfilm and getting the material into the machine ready to use, that microfilm may be more expensive in total cost for the average periodical article or report than is a full-size or substantially full-size copy on paper. This does not apply to more or less dead storage of long runs of little-used materials, in which microreproductions have great advantages over full-size copies, at least up to the point of use.

It may well be that we could profitably do further research on high speed selection of materials stored in microfilm form and its high speed, low cost reproduction in substantially full-size form for use where and when needed.

A good deal has been done in the development of so-called dry processes. Actually none of these, including the diazo-

dye, gelatine transfer, or dye transfer processes will work in the absence of moisture, so the processes are various levels of semi-dry processes. The one exception is the physical process developed by Nieset at Tulane University which is just coming on the market under the trade name Kalfax. By and large, the dry processes use slower materials than do the silver bromide processes; in addition, except for diazo, they use more costly materials. Thus for most purposes, where there is any appreciable volume of copying to be done, these processes do not provide anything except freedom from the untidy technology of the darkroom, at a considerably higher cost, and generally lower quality, for the substitutes. They are suitable in offices in which only an occasional copy is required.

A better solution would appear to be the new effort towards mechanizing the technology of developing and fixing or stabilizing silver bromide prints automatically within the camera, which retains the quality and relatively low cost of silver bromide materials without increasing labor and materials costs. Another possibility would be the development of technology for direct production of images on dye papers at about the speed of production of silver bromide prints, and at a lower material cost. Neither of these is now being sold.

The preceding discussion does not cover all processes or all the steps in all these processes, but it indicates that there is a wide range of alternatives available in the primary job of communication, and that it is necessary to consider all the factors involved in deciding which is the proper method for a given purpose.

Distribution and Copyright

This discussion of the communication process would not be complete without some consideration of factors other than these mechanical production factors that affect scientific communication. These other factors include restrictions on distribution and methods of distribution.

There are many types of restriction on the free flow of scientific information. One which comes up constantly and which has been used to interfere with the right of scholars to access to scholarly materials is that of copyright. A number of libraries refuse to make copies of materials contained in works that are in copyright; others rely upon general agreements, which do not cover a large part of the material in the collections and which are of doubtful value in protecting the library from an infringement suit in any event. Basically, there appears to be only one sensible approach to this matter, and that is to follow the theory of private use. It should be noted that in spite of a history of some fifty years of copying services in the United States no one can point to a single case in which a library was even brought into court, let alone adjudged guilty of a violation of copyright, for making copies for scholars on demand. In a few cases in which libraries have requested blanket permission from publishers, they receive permission from some, denial of permission from some, and no answer from others (which is effectively a denial). Even where permission has been granted, the owner of the copyright in the journal as a whole may not be the owner of a considerable number of its parts, and if violation is involved, a copy of a single page of a newspaper, from which permission has been obtained, may involve the simultaneous copying of copyrighted feature articles which are not the property of the newspaper.

The confusion stems primarily from two sources. One of these is the natural desire of the representatives of publishers to extend the value of their property to its maximum limits, and the other is the confusion by librarians and scholars of the plain ordinary English verb "to copy" with the legal meaning of copying in the sense that would constitute a violation of the copyright act. There are several fairly clear cases in English law which deal with this point. In the case of Abernethy

vs. Hutchinson (L.J. Old Series 3:209, 217, Cases in Chancery, 1825) the Court said, "I have not the slightest difficulty in my own mind, that a lecturer may say to those who hear him—'You are entitled to take notes for your own use, and to use them, perhaps, in every way, except for the purpose of printing them for profit; you are not to buy my lectures to sell again; you come here to hear them for your own use, and for your own use you may take notes' . . . " Similarly in the case of Nichols *vs.* Pitman (L.R. Chancery Div. v. 26, p. 379, 381, 1884) the Court said, "The Defendant is a shorthand writer, and he attended and took down a copy—almost verbatim—of the lecture in shorthand; which of course he had a perfect right to do. Merely taking down a lecture in shorthand is not a breach of any right at all. The Defendant might take notes of the lecture and use them for the purpose of refreshing his memory, or for any similar purpose he might choose.

"The question here is whether having taken the lecture down he had a right to publish it and for profit."

And the Court went on to say, "He was, therefore, clearly of opinion, that, when persons are admitted as pupils or otherwise to hear these lectures . . . and although the parties might go to the extent, if they were able to do so, of putting down the whole lecture by means of shorthand, yet they could do that only for the purposes of their own information, and could not publish for profit that which they had not obtained the right of selling."

It should be noted particularly that the Abernethy case transferred this reasoning to publication of a book.

Quite clearly, making a copy is not a copying in the sense of the copyright law; and quite clearly it was never intended that private use was to be affected in any way by the copyright. Copyright was and is still intended to protect the author against use of his labors publicly by others for profit without sharing those profits with the author. It is, at least in the United States, clearly and primarily intended to make the author's information available, and it is for that purpose that our Constitution empowers the Congress to grant a monopoly of public uses.

Actually, it would be impossible to stop private use even if it were intended to have the copyright law effect that undesirable end. To enforce such a law would require stationing a policeman with every copy of every book to make sure that no one made notes. Also, since committing it to memory and then using a copyright work publicly is a violation of the copyright, we should have to develop new orders of intellectual detection to determine whether any of the material was being memorized.

Furthermore, if libraries were accessories to a crime in providing copying services, they would also be accessories by providing chairs for the scholar to sit in, tables at which to write, and light and other services to enable him to do it.

This is obviously ridiculous. But why draw the line between selling fountain pen ink to a man so that he might copy, and permitting him to use his own Contoura camera or to have his agent do for him what he rightfully can do himself?

The only reasonably sane solution is to recognize that private use is completely outside the scope and intent of restriction by copyright. If a later public use is made, that may be a violation of a copyright; but that would be independent of whether the violating use were made from the original, from a copy written out in the man's own hand, or from a photocopy provided by a library; the copying which would be a potential violation would be the public use; and the act of making a copy for private use is obviously (to this writer, at least) not a violation of anything at all.

One of the arguments that ought to be investigated a little further is the fear of publishers of books in small editions that the new forms will reduce sales enough to make the edition uneconomical.

There is no evidence that this has ever happened. But to counter a generalization based on no evidence with a generalization based on one case, the writer's own book on copyright was and still is available in microfilm from the University of Chicago Library. It has been advertised in their list of dissertations available from time to time since 1950. Since the author had to pay for the negative it is possible for the library to sell the film for somewhat less than half the cost of the printed book. The printed book was published in an edition of a thousand copies, which were sold out by the end of 1952, and now brings a premium in the out-of-print market. The microfilm edition has sold three copies from early in 1950 to mid-1955. Certainly, if we are going to restrict the right of scholars to access to materials to which they have every right to access, we should have more definite evidence than the vague fear that the publisher may not be able to issue a book because microfilm will take over the market.

Furthermore, it should be noted that none of the photographic processes can compete with the book in print, either in price per page or in convenience of use. It is only in the case of the rare book (in which the author's likelihood of profit is very slight indeed) that the price of the book is likely to be greater than that of a photographic copy.

Furthermore, if we agree that the scholar has the legal right to go to the library himself to copy the book by long hand, but does not have the right to have it done for him by an agent, we are only discarding the well established law of agency, we are in the ridiculous position of insisting that the scholar has the right to make a copy for his private use only if he does so under conditions of maximum inefficiency in the use of his time and resources. If that were the law, then we can only respectfully refer to Mr. Bumble in *Oliver Twist*.

In view of the fifty years of experience in this field and until there is some persuasive evidence against the theory of private use, and in view of the fact that there is no court record, in the United States at least, that would give any indication of violation by copying in lieu of manual copying by the scholar and for his private use, it would seem that an unwarranted timidity on our part interferes with the advancement of science.

Copyright is but one of the bars to free communication of scientific information. Some are derived from the fact that no patent can offer as good protection as a trade secret that can be kept, and others derive from the needs of governments to protect themselves in these parlous times. Others result from the fact that the book trade cannot market short-discount books, and still others derive from the fact that currency restrictions still exist in a good many parts of the world, many of which are not reached by even a trickle of Unesco book coupons. In fact, the restrictions on free flow of scientific information are so varied and so great that if it were not for the fact that we do manage to publish many thousands of books and articles each year and to list a substantial portion of them in bibliographical tools and to make a great many of them available through library loans or copying services, this picture might be downright discouraging.

No matter what we do about the reduction of manufacturing costs, overhead and the cost of selling books will still be the major factors in determining whether they can be produced without subsidy.

A far-flung organization, suitable and essential for marketing trade books, costs very little per copy for the 10,000-copy book. It costs so much per copy for the 500-copy book that even if the manufacturing were free, and the pricing were exorbitant, it is doubtful that the 500-copy book could pay its own way in a firm designed for trade operations. The costs of selling books, including design of pretty book jackets, advertising, bad debts, etc. are also small costs per copy

and are necessities in the trade book; they are prohibitive in the 500-copy book.

Much of this stems from the deep rooted belief on the part of authors and publishers alike that a book is a failure if its sales do not run into five figures. But the approach (which results in overhead and selling costs) for the design, production and distribution of the book of five-figure sales is what makes it "impossible" to publish the book which will count its sales in three figures. Until we realize that the minimum essential distribution of a scholarly book is more important than no distribution, we will continue to have trouble with this problem. After all, if a book is available to scholars in 300 to 500 libraries all over the world, its intellectual content is quite readily available to those working at the frontiers of knowledge, and it might, therefore, be assumed that that is our minimum social and professional responsibility for the seminal book. As a matter of fact, if as few as 300 to 500 specialists and the libraries that serve them would agree to take automatically (and pay for) properly refereed books in their special subject fields, there would be no problem of publishing the seminal books in the sciences or other scholarly fields; and since the marketing costs would largely be eliminated under such an arrangement, the price could be held down to a very reasonable level. This would require recognition of the principle of ensuring at least minimal availability, the establishment of narrow categories for subscription, an impeccable board of referees for each of the categories, and, above all, the willingness of those who are concerned about the problem of publishing seminal books, both subject specialists and the libraries that serve them, to do the one thing that would solve the problem of publishing these books—and that is to buy them.

Summary

Considered again, in summary, as a communications problems, although there are some problems, there has been much progress.

We have single-copy processes that can and do make almost anything that exists in the civilized world available to any scholar who needs it, has the perseverence (or librarian) to find it and the contacts to get it.

We have small edition processes, primarily in reduced facsimile, which can produce editions of as few as 25 copies.

We have reduced offset and offset processes that can reasonably produce editions of 100 to 500 copies.

We have a few small, low-overhead publishing houses that can produce editions of 500 to 1,000 copies or more without subsidy; and assuming that the marketing could be simplified by automatic marketing through interested societies and groups, this edition limit could probably be reduced to 300.

We have university presses, which can fill the gap between the 1,000-copy book and the 2,500-copy book with subsidy, or the 2,500- to 5,000-copy book without subsidy.

And we have a strong and efficient scientific publishing industry that can take over from that point.

Thus, counting our blessings rather than our shortcomings in this field, what is remarkable is that we have come as far as we have in the field of scientific communication. We still have problems to solve, and there are a number of areas in which objective study should develop better, cheaper, and more effective tools of communication. But the time appears to have come to give up our pleasant habit of fulminating about generalities about the sad state of scientific publishing. Let us substitute the scientific method in the field of scientific communication, identifying the problems, investigating them to determine their true nature, their scope, and their frequency so that we can determine and apply the suitable amount of effort and the suitable levels of design and execution to their amelioration or solution.