Technical-Communication Fundamentals in an Era of Technological Change†

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High-technology communication systems that employ computers, cathode-ray screens, micrographics, and video disks will undoubtedly be used to an increasing extent. However, the quality of their messages and the ease with which these can be read will be considerably lessened unless system designers apply or adapt more of what is already known about textual presentations and unless we ourselves pay better attention to how we write.

We and our more immediate ancestors share a number of traits and problems with primeval man. Among these are the urge and need to communicate, to translate thoughts into spoken and textual (or at least pictorial) messages, and to reverse this process.

In recent years, much has been learned about how the brain, eyes, and other parts of the body are involved in these efforts. In the several centuries since Gutenberg, much has also been learned about printed communications. Until recently, however, most of us have been content to delegate studies and decisions in the latter areas to students of psychology and linguistics and to graphic-arts designers, editors, and publishers.

Now, however, we find ourselves part way into an era of technological change, one in which our stenographers can seemingly substitute for compositors and our office equipment for printing presses. More and more of our textual messages are coming to us on desk-equipment screens, with the involvement of computers and telecommunications.

This is an era with exciting and unprecented opportunities for high-quality progress, especially if we can avoid some of the pitfalls that have slowed our more-mundane steps in the past. It is also an era in which we must be certain that the new players are trained in more than keyboard arts. And we cannot be certain of this unless we, ourselves, understand clearly the fundamentals of textual communication, presentation, and transmission. Too often, we have failed to do that in the past. Now is the time.

In this paper, therefore, I shall review some of the existing technical-communication fundamentals, especially those for printed communications, and shall discuss them in terms of the new communication technologies, especially those involving computers and cathode-ray tubes. We will not find one-to-one correlations everywhere, of course, but I hope that you will agree that we can usually apply the same principles constructively.

EFFECTIVE WRITING

First and foremost among the aforementioned pitfalls have been our individual and collective problems with the English-language principles of syntax, semantics, and rhetoric: how to organize the written expressions of our thoughts and work clearly, effectively, and grammatically. Some of the portents are not very encouraging here, as Table I attests. As you may note, in 1980 not quite 3% of the high-school seniors who were tested scored 650 or better on the verbal part of the Scholastic Aptitude Test (SAT), compared with a little over 5% in 1972. These results show "a real decline in developed abilities",[1] because there is little reason to suspect any rapid decline in inborn ones.

Table I. National SAT Verbal[a] Scores[1]

	1972	1975	1980	1972–1980 change, %
average score	453	434	424	−6
students tested	1 022 680	996 391	991 056	−3
students scoring above 650, no.	53 794	33 457	29 019	−46
%	5.26	3.35	2.93	−44

[a] Reading comprehension, understanding of word relationships, and vocabulary, the complex intellectual abilities developed through schooling to do the analytical work required in writing papers.

We in the sciences and engineering are also aware that we have been unable to persuade most of the college students in our professions that learning how to write well is anywhere near as important to their future careers as other studies. We must learn how to do this, because there is nothing inherent in the developing technologies to indicate that clear expression will become less important. We must look for better ways to motivate students to learn how to write well, and we must not leave this entirely to teachers of English.

I have just said that nothing in the developing technologies indicates that clear expression will become less important. I believe this, and because of this I urge a measure of caution when we look forward, as we should, to obtaining more and more hard data from computerized data bases. We must be certain either that these data are evaluated data that can safely be employed without context or that they are accompanied at least by the corresponding bibliographic references, which brings us back to the continuing need for original publications that are clearly written.

In using the new technologies, moreover, we must also continue to resist the temptation to downgrade our communications because of economic exigencies. Some 20 years ago, when computers first began to be used to store bibliographic data bases, designers of the computer systems involved seized eagerly on the false proposition that titles are as good as abstracts, so that the text of abstracts need not be included. I have written on this subject before.[2] Where would we be now, in our use of online bibliographic data bases, if abstracts were unavailable in any of these bases? I repeat Russell Rowlett's answer to the title of his 1981 NFAIS Miles Conrad Memorial Lecture on "Abstracts, Who Needs Them?":[3] users of the literature need them, especially searchers. And what literature users will continue to need is well written, preferably informative abstracts.[4,5]

Related to this, we are beginning to hear more, again, about computerized full-text searching. We know that the American

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0095-2338/81/1621-0119$01.25/0

8 point 3.3 characters per pica

In printing we need to use a type size that is large enough to be easily readable for a given line length, but not so large as to be wasteful of space or actually uncomfortable. Even when this requirement is satisfied, the maximum line length that is readable for most type

9 point 2.9 characters per pica

In printing we need to use a type size that is large enough to be easily readable for a given line length, but not so large as to be wasteful of space or actually uncomfortable. Even when this requirement is satisfied, the maximum line

10 point 2.6 characters per pica

In printing we need to use a type size that is large enough to be easily readable for a given line length, but not so large as to be wasteful of space or actually uncomfortable. Even when this requirement is

11 point 2.4 characters per pica

In printing we need to use a type size that is large enough to be easily readable for a given line length, but not so large as to be wasteful of space or actually uncomfortable. Even when this

12 point 2.2 characters per pica

In printing we need to use a type size that is large enough to be easily readable for a given line length, but not so large as to be wasteful of space or actually uncomfortable. Even

14 point 1.9 characters per pica

In printing we need to use a type size that is large enough to be easily readable for a given line length, but not so large as to be wasteful of space or

Figure 1. Type size and number of characters should be easily readable for the line length used.

Chemical Society, among others, is studying its potentials. At this point I know of no studies that tell us specifically whether the efficiency of such searching will be related to how well the text is written or organized, but that may be so. Some early work on "automatic abstracting" (really, computerized extraction of key sentences) yielded a high concentration of sentences from the documents' introductions, because these introductions discussed the purposes and backgrounds of the studies in the most concrete terms. This problem, of course, could be avoided in modern full-text extraction by not searching the introductions. However, here again we certainly do not know that the need for good writing will be lessened.

I will present some writing fundamentals later in this paper.

OPTIMAL PRESENTATION

Let us look, now, at some of the potentials and pitfalls concerning the optimal *presentation* of writings—at printed publication and image projection, including some effects of telecommunication.

For printed or typed publications, we have reached the point where some graphics experts and psychologists know quite a number of the factors that relate to legibility and speed of reading, factors that usually have some teachings in regard to the modern technological developments.

(1) In printing, we need to use a type size that is large enough to be easily readable for a given line length, but not so large as to be wasteful of space or actually uncomfortable; see Figure 1. The maximum line length that is readable for most type fonts is somewhere between 1.5 and 2.5 alphabets—39–65 characters, but optimally close to 39 characters. This is because for any suitable type size the average eye span—the width of the line perceivable with one fixation of the eye muscles—is about 1.5 alphabets of normal-width, lower-case characters, so that lines much longer than two alphabets require extra physical effort in reading. Fortunately, vertical eye travel from line to line is less tiring than horizontal eye-travel fixations.[6]

From the examples shown in Figure 1 we can readily see that 10-point and 11-point typeset compositions are suitable, preferably with some "leading" (extra space) between the lines,[6] for single-column lines on pages in a typical book. (There are 72 points in an inch, or six picas. Much type is set in six lines to the inch, often as 10-point type with a two-point leading, which is also referred to (from hot-type phraseology) as "10-point on 12"—10-point type set on 12-point lead slugs.) However, *typewritten* compositions in these sizes (Elite = 10 point, Pica = 12 point) are not optimally easy to read in typical single-spaced lines on letter-size typing paper, where an Elite-typed line ("12-pitch", or 12 characters to the inch) usually contains 72–78 characters. That is why we must often resort in typing to double spacing in an effort to lessen the visual confusion and fatigue caused by lines that are overly long.

(2) Text is readable much more quickly when it is not set entirely in capital letters.[6,7] This is at least partially because most of us read words and word groups instead of simply character by character, and because the top half of a line (the most unlike part) is the part that transmits most of the message, as shown in Figure 2. Our eyes apparently pick up patterns (pictures) when lower-case characters are used that do not exist when all the characters are of the same height, that is, when all the characters are capital letters. For "lower-case" text it is also known that the first and last characters in a word are the most important in painting its picture, something that has no meaning for words that are in all-capital letters.

(3) Figure 3 shows samples of two much used types—Times Roman, a serif type, and Helvetica, a sans-serif type—and also an interesting "intermediate" type—Optima—a sans-serif type,

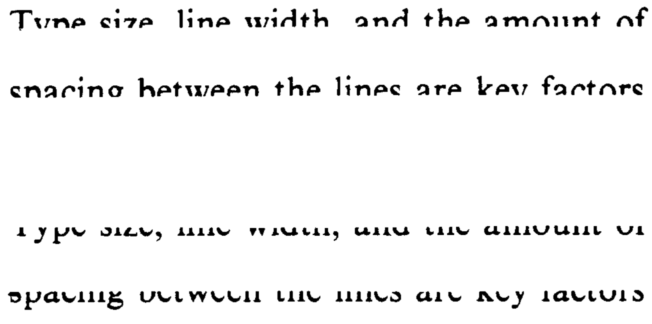

Figure 2. The eye receives most of its signals for identification from the top half of the line.

Times Roman

Exxon authors know a considerable amount about good writing, and about the writing mores within their

Optima

Exxon authors know a considerable amount about good writing, and about the writing mores within

Helvetica

Exxon authors know a considerable amount about good writing, and about the writing mores within

Figure 3. Use of serifs and differences in stroke widths help to improve legibility and relieve monotony.

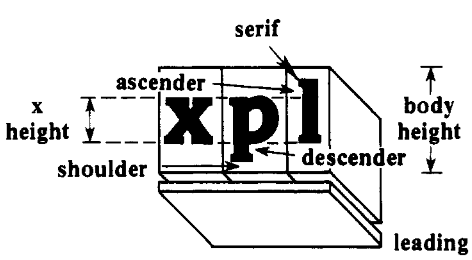

Figure 4. Some terms still used in describing type, derived from portions of lead ("hot") type.

but one that, like Times Roman, has differences in its stroke widths. Serif-containing (Roman) type faces are traditionally considered to be more readable than those that are sans-serif (Gothic), although the latter are thought by some to be more legible, hence excellent at least for display work (headings, etc.).

As may be noted in Figure 4, serifs are the short crosslines that mark the ends of connected letter strokes; they contribute to the unlikeness of letters and are also though to be helpful in carrying the eye along the printed line.[6,7] Roman (serif-containing) type faces are usually also typified by marked contrasts in the thickness of the strokes; the thicker strokes are said to be the elements of letter identity that the thinner strokes tie together. The "*x*" height of the characters, the height of ascenders and descenders, the width of the characters, maximum dissimilarity among like characters such as c, e, and o, the spacings between words and lines, and certain other aspects of type design are also related to legibility as well as to esthetics.

However, reading tests do not disclose appreciable differences among the serif and sans-serif type faces that are in common use,[7] and some publishers have departed from tradition by using sans-serif types even for the texts of books. In my opinion, this leads to a monotonuous appearance if the text is unbroken with equations, illustrations, etc., for any considerable length.

What lessons for modern technological developments may we derive from these printing-composition teachings? The most basic one devolves from the fact that the printing in all too many computer printouts is still completely in 10-point capital letters, and that all too many lines in computer printouts are still 80 or more characters long, photoreduced, the "80" having been derived long ago from the number of columns in an IBM punched card. Fortunately, more and more modern computer programs for textual printouts now contain codes for both lower- and upper-case composition. Where they do not, the number of all-capital characters ought not to exceed about 40. Moreover, such lines should not be photoreduced more than about 10%.

All of this is particularly important in computer printouts and copies of printouts that are designed for direct use by scientists and engineers. These human beings are not supposed to "judge a book by its cover", but at the least it is bad public relations for communication professionals to force them to read products that are poorly designed. One concrete example that comes to mind is a COM (computer output microfiche) library book catalog that contains single-spaced, 120-character lines, all in capital letters. This microfiche system was placed in a library to replace a manual-use card catalog that had contained nicely printed Library of Congress cards.

In regard to type style (serif vs. sans-serif type faces), the use of sans-serif types is certainly permissible and seems to be preferred for the short lines employed in TV-screen images. This preference may well not be based entirely on legibility, however, since TV-screen texts are all too often set completely in capital letters.

Let us look at some additional printing fundamentals.

(4) In regard to the colors of printing and paper, there are few significant differences in readability (speed of reading; visual comfort) if the printing is in high contrast to its background, that is, if it is in a dark color on a white or pastel background. Black printing on a white or offwhite (ivory) paper that has a dull finish and good brightness (reflectivity) is very readable; paper finishes that are highly glossy can give uncomfortable reflections under conditions of uneven lighting. (Remember, what is properly reflected to our eyes is the *outline* of the black image against the reflective background, not the black image itself.)

(5) "Black print on a white background is much more legible than white print on a black background ··· due to the larger number of (eye) fixation pauses required to read the white on black".[7]

(6) In books and magazines, the inner margin or gutter should be wide enough so that the curve of the paper does not obscure the inner ends of the printed lines. Significant curvature there can significantly reduce the legibility of the print and the speed of reading.

(7) Esthetically, book pages are supposed to be designed to devote at least 50% of their space to margins, since even then many readers believe that 75% of the page is devoted to the printed area. However, "while readers believe that ample margins are justified either in terms of esthetics or improved legibility, ··· experimental results show that (printed) material on a flat page with no margins at all is just as legible as material with the usual large margins".[7] Tinker also reports that not many technical books actually have 50% of their space devoted to margins, and he believes that a considerable reduction in margins may be warranted, except for the gutters. Many disagree, at least on the basis of esthetics.

These last several teachings have various meanings in terms of the advancing technologies. Some of them seem already to have been perceived by the designers of recent micrographics readers and display (cathode-ray) computer terminals; others have had to be contravened because of the differences between images perceived by light reflected from paper and the direct images produced by micrographics-reader light sources and cathode-ray tubes.[9,10]

For equipment employing illuminated screens, most of us have learned that negative images—light text on dark backgrounds—seem to be preferable for text displays, and that reading these may not be slower here. We simply are not comfortable, for long, with the glary white backgrounds that accompany many lighted positive images, at least on micrographics readers. However, even here the white backgrounds need not be so glary (illumination need not be so high) if the black images are really sharp—if they are not cursed in microform projections by high-magnification fuzziness from poorly filmed originals or badly prepared originals or by low-resolution fuzziness in home-TV-type cathode-ray images. I have seen some very sharp, very readable positive images on commercial cathode-ray-tube readers, images that were produced by transmitting by wire some digitalized pictures of text pages from microfiche in a system that employs both high resolution (1500 lines per in. per h) and image enhancement. Admittedly, this system and its equipment are presently quite expensive for small installations.

Indeed, the high cost of high resolution is presently a major limiting factor in the transmission of high quality printed images. While we hear much about videotex and similar message transmissions to home-type TV sets, the large-character images that must be produced because of the low resolution of the cathode-ray tubes in these home-type sets limit the number of characters per line and the number of lines per screen, so that even with scrolling (upward movement of successive lines) the text cannot be read very quickly. Also, high resolution does not come cheaply in images transmitted by telefacsimile, even with digitalized telefacsimile.

Incidentally, while the more expensive COM recorders can produce text in conventional type faces, many COM recorders use "shaped-beam cathode-ray tube" character generators, or "dot matrix" character generators. Lower-case as well as upper-case characters can be generated, but type sizes and spacings are limited.[10] Unfortunately, there is evidence, so far, that the designers of COM outputs are not much more skilled in graphics than are those who produce their computer products in all capital letters by impact printing.

Because good contrast between the text and background is more difficult to obtain in illuminated-screen images than it is in printed ones, micrographics-equipment manufacturers seem to have resorted to the use of colored screens to improve this, or at least to lull irate users. Green or blue glasses are common on microform readers.

Light images on dark-green backgrounds are also commonplace on cathode-ray tubes in computer terminals and word processors. Cable-TV broadcasts of displayed texts run the gamut of the rainbow; my own observations are that white, all-capital letters are somewhat harder to read on blue and red backgrounds than they are on green. However, Tinker[11] reports an early study on the legibility of color combinations on poster boards and road signs that showed the order of legibility to be white on red, white on green, and white on black. A recent text in the field of library design.[12] which has some good information on the use of color, points out that "highway signs use color for legibility. All federal signs use white on green; state highways use white on blue. White on red is used for STOP signs".

Until now, I have avoided analogies from slide projection. The information on preparing slides that accompanies the American Chemical Society's "Standard Abstract Form for ACS Meeting Papers" (not dated) says: "Use a dark-colored background—it is better than black or white", and some ACS speakers have followed this literally and liberally. Personally, I prefer to employ a negative-image, tinted text on a black background; color emphasis is thus on the text, not the background.

Insofar as I know, the matter of margins in screened images has not been extensively explored. We have long heard, of course, that the room background for viewing a television set should preferably be lighted for eye comfort, presumably to minimize contrast and eye fatigue, and I have always considered that this is analogous to providing good margins on printed paper. A colleague who has considerable experience with word processing urges the use of bigger margins for screened images than for paper, although the opposite is usually the case on microform readers.

Of course, what we now have available to use in the way of new-technology systems and equipment is "only the beginning", the Model-T versions. This probably means that this second set of teachings will have considerably more meaning in the future. But it also means that we should expedite the arrival of this glorious future by our own efforts, and that we should not remain silent when we are presented with shoddy equipment and textual outputs of low quality.

As we can see, of course, modern communication equipment also has its own design and formatting requirements,[9] in addition to or distinct from those that carry over from paper compositions. Microform readers and reader-printers, while not yet "cuddly", do need to be designed to permit their screens to be at heights that are comfortable for their readers, including readers with bifocals. Computer input and output terminals need "friendly" keyboard designs, especially for the commands; I note recent progress toward this. I am certain, also, that some voice commands will be increasingly employed as terminals become staple items in offices and homes.

Incidentally, when documents are microformed page by page or card by card, they really ought to be filmed so that their images will flow up the screen of the microform reader, i.e., "scrolling", instead of moving horizontally across it, a motion conducive to eye fatigue and user dissatisfaction. This can be as true for microfiche, that is, filming in vertical columns rather than horizontal rows, as it is for roll film. If filming is done this way and if the microform readers are designed to permit upward flow (many are), user resistance to the use of microforms can be materially reduced.

WRITING FUNDAMENTALS

Let us turn, now, to some fundamentals of writing, and of distributing writings, that will continue to warrant attention as our messages move more and more from paper to electronic transmission.

(8) Say what you want to say accurately, clearly, and concisely. And say it effectively; make frequent use of active voice and the first person.

(9) Put first things first, but do not discuss a subject before presenting it. Unless you have a hostile, completely ignorant, or uninterested audience that must first be made more receptive before you can give them your message effectively, tell them what you are going to tell them; give them the details; and then tell them what you have told them. Most readers do not prefer factual-text equivalents of O. Henry mystery stories (see Figure 5).

(10) Pace what you say and how you say it. Do not outrace your readers' ability to comprehend what you are saying: that can necessitate occasional rereading. However, do not allow

So tell me quick and tell me true,

Or else I haven't time for you.

Not how your study came to be,

But what you found that can help me.

Figure 5. Readers of factual information do not want O. Henry mystery stories.

The word-processing composition of justified or
near-justified lines does not include automatic hyphenation
in most systems that employ word processing. Also, these
systems treat hyphenated compound words, hyphenated unit
modifiers, or words separated by a dash (two hyphens) as if
they were unbroken words--do not automatically break them
after the hyphens when that would yield lines that are more
even in length.

Figure 6. Line-end hyphens are occasionally needed in word processing.

readers' minds to lag behind their eyes; you can lose them that way. Do not include too many points in a sentence or paragraph, but also keep your message coming: do not drag out your points.

(11) Be honest in what you say. Do not hide the existence of incomplete or conflicting data. Do not be too modest, either. Describe your findings clearly and objectively.

(12) Work hard to make your words, sentences, paragraphs, and sections flow optimally to put across your message. Be coherent. Use connectives and transition words to their best advantage; do not force your readers to reread for continuity. Avoid long sentences and long paragraphs. To clarify your message, make frequent use of headings and subheadings, enumeration (or emphasis dots), and other aids to readers. These aids are perhaps even more important for screened texts than they have always been for printed texts.

(13) Revise, as many times as you can. Seek colleagues' opinions (the next generation of computer conferencing should be excellent for doing this). Consult with in-house editors if they are available.

(14) Be receptive to new findings on writing efficiency, but do not be slavish in how you apply them. For example, many have felt uncomfortable, esthetically, with formal publications that do not contain justified lines—lines with a uniform right margin. Recent studies have demonstrated, however, that uneven line endings in no way hamper speed of reading. Indeed, studies have shown that word hyphenations at the end of lines actually slow reading perceptibly, possibly because they tend to force readers of word pictures to retain word fragments in memory until the pictures can be completed.

Nevertheless, I, for one, am not going to stop using line-end hyphenation completely; Figure 6 shows what can happen without it in word processing. Moreover, when text is justified on word processors and computer typesetters in lines that are relatively short, the lack of automatic hyphenation and bad page-end breaks can sometimes yield lines that contain words spaced widely apart (Figure 7). Hyphenation of the first word in the next line or rewriting of the text are the usual remedies.

(15) Use at least some variety in your sentence structures, despite another recent "finding"[13] that simple sentence structures read faster than complex ones, especially than sentences beginning with a dependent phrase or clause. This has long been known to grammarians, of course. Nevertheless, the monotony of works written exclusively in simple sentences can lose your audiences quickly; so for printed or typed works I still believe that there is merit in employing some variety in sentence structures, consciously or unconsciously. This may not be true for screened images, however; here, easy readability may need to take precedence over stimulating interest.

(16) Do not do away with publishers and reviewers. Do not permit authorities to foist on you a computerized, telecom-

Computers, satellites, video disks, and other modern
technological developments are already revolutionizing the
transfer of information, data, and knowledge. Among those
directly involved in this revolution are physicists,
electronics engineers, computer programmers, and
technicians, in close consort with manufacturers and
business economists, and, to an increasing extent, with
inputs from information scientists, librarians, and
publishers. In the rush, only a few of these seem to be
giving much thought

Figure 7. Lack of automatic hyphenation and bad page-end breaks can cause problems when justifying text on word processors.

municated communications system in which anyone can input any messages that they desire, regardless of validity, accuracy, and clarity. Insist on peer review for your own published writings. And recognize that publishers or their equivalents will always be needed to collect, verify, purify, and market your messages.

You will have noted that I have not tried to make this an exhaustive review—that might have required writing a book, not a paper. The literature is vast on aspects of printing, including such matters as page layouts. There are lessons to be learned from those who have worked on ease-of-reading scores. As I have noted in passing,[9] some good literature already exists on legibility aspects for the new communications media, although much remains unexplored. A good review[10] appeared in 1979 in the *Journal of Documentation.* Our British colleagues are as thorough about this as ever, and much good work is being done by the Readability of Print Unit of the Royal College of Arts.

So, what does all this mean, in context? In my opinion, it means that we must firmly acknowledge that computers, video disks, satellites, and other modern technological developments are revolutionizing many aspects of the transfer of information, data, and knowledge. We also know that among those directly involved in this revolution are electronics engineers, computer programmers, and technicians, in close consort with manufacturers and business economists, and with the growing involvement of information scientists, librarians, and publishers. In the rush, only a limited number of them seem to be giving direct thought to the readability and user appeal of the messages being transmitted, and to whether in the transition these babies are being thrown out with the bath water. It is just possible, however, that papers such as this may serve to remind us that much that has been learned in the past should not be forgotten or ignored, and that we should commit ourselves to seeing that this does not happen.

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Patent Coverage by Abstracting Services. 4. Coverage of Microbiological Patents

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The paper reports a study on the coverage by seven major abstracting services in the field of microbiology in regard to patents. Only three of the services—*Chemical Abstracts*, *Microbiology Abstracts, Section A*, and *Food Science and Technology Abstracts*—cover patents at all. We assessed the three services in terms of the information they provide about patents and then in terms of their performance in retrieving patents taken from a master list of patents on genetic engineering and Vitamin D, obtained by searches on *World Patents Index*. Timeliness of the three services was also assessed. We found that none of the standard abstracting services in the field cover patents satisfactorily and they are slow in picking up patents. The research demonstrates that by scanning just Japanese, Soviet, U.S., and British patents, both timely and comprehensive coverage of the microbiological patent literature can be obtained.

INTRODUCTION

Industrial processes involving the use of microbiological processes or products are many and varied. There is a long history of patenting of such processes and products. The recent controversy over the patentability of genetic engineering processes has resulted in an increased awareness of the importance of microbiological patents, that is, patents which are in some way concerned with microorganisms. With this in mind, we carried out a study to assess the coverage of microbiological patents by major abstracting services and suggest methods by which such abstracting services can improve their coverage with a minimum of expense.

This paper is one of a series from this Centre which have had as their object the demonstration of the importance of patents as sources of information and the coverage of patents by abstracting services in a variety of subject areas.[1-7] The results of these studies have been confirmed by research originating from outside the Centre.[8-11] Most of the previous research has concerned itself with chemical patents but has been used to draw the overall conclusion that patents are a useful source of information for the whole of science and technology. On the basis of the results obtained for other subject areas, the following conclusions regarding microbiological patents can probably be made: a significant proportion of useful microbiological information is disclosed in patents and not in any other form of literature; even when the information is duplicated in (say) the journal literature, it will have appeared in the patent literature much sooner, unless the patent has appeared only in the U.S. Most major patent-issuing authorities in the world have adopted the "deferred examination" system, which leads to quick publication, but the U.S. has not done so.

Others have reached similar conclusions. According to Gollin,[12] the patent literature can be of considerable value to microbiologists. Bannister and Oppenheim[3] concluded from their study that patents represent an important source of information regarding microorganisms. For these reasons, the performance of the major abstracting services in covering microbiological patents should be of concern to all who have to search the microbiological literature. There appears to have been only one statement in the professional literature regarding the performance of abstracting journals in this respect. Turner, in 1967, stated that *Microbiology Abstracts, Section A*, provides excellent coverage of microbiological patents. He wrote that 75% of the journal consisted of patents, and the publishers were said to monitor 25 countries in order to provide this service.[13] Unfortunately, Turner provides no evidence to support these statements. Other statements in the same article regarding the performance of *Chemical Abstracts*[13] have since been demonstrated to be unjustifiably optimistic.[5]

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METHODOLOGY

We looked at seven major abstracting services in the field of microbiology. These were *Biological Abstracts*, *Microbiology Abstracts, Section A*, *Food Science and Technology Abstracts*, *Excerpta Medica: Microbiology*, *Chemical Abstracts*, *Genetics Abstracts*, and *Current Advances in Genetics*. Initially we looked at their policies regarding coverage of patents. Those which did not cover patents were not studied further. For the journals that did cover patents, the nature of their patent coverage was examined in greater depth. We looked at the indexes which allow retrieval of patents, the content of a typical patent citation and the method of handling equivalents. We noted the countries whose patents were covered. We noted the number of patents abstracted per annum and the proportion this represented of their total abstracting effort. We subsequently took a random sample of microbiological patents and used them to estimate the percentage of the microbiological patent literature that is covered by each abstracting service. Where microbiological patents were covered, we carried out an assessment of the timeliness of each abstracting service. The original sample of patents was also used to examine the pattern of filings worldwide. This was done in order to formulate recommendations as to how the services could improve their coverage of patents. Details of the methodology are described later in this paper.

PATENT COVERAGE BY THE MAJOR ABSTRACTING SERVICES

Only three of the seven abstracting journals examined cover patents at all. The three are *Chemical Abstracts* (CA), *Microbiology Abstracts, Section A* (MA), and *Food Science and Technology Abstracts* (FSTA). It might be argued that

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