THE FUTURE OF COPYRIGHT

In our recent JCICS feature article on "Copyright Basics and Consequences", we went into great detail on the consequences of recent legislative developments, judicial decisions, technological developments, and proprietor/user interactions. We will not repeat these consequences here except to say that copyright is complex and its issues are controversial. "Frankly, this field is so complex that we see no other mechanism that presently could work better. We can only urge patience, good ethical practices, and cooperation instead of confrontation."[3]

The temptations of technology are increasing rapidly; photocopying may pale in comparison with new, better, faster, and cheaper methods of document access, replication, and delivery. Copyright-statute revision has always lagged behind technology developments, but never before have the latter been advancing so swiftly. When the advancements are combined with the popular clamor for free access to the fruits of creative endeavors and with the difficulties in detecting many of the statutory violations, copyright provisions are put to the test, and the need for statutory changes becomes evident, hard as it is to obtain them. Procedures, mechanisms, policies, and guidelines must all be worked out to allow us to take advantage of the new technologies while still protecting the rights of creators and copyright owners.

We will no doubt see further amendments to the current Copyright Law. We believe that "copyright"—protection for intellectual rights—will prevail over the forces arrayed against it. Meanwhile, copyright will continue to be analyzed and interpreted, and papers on the subject will fluorish in JCICS and the literature at large.[32] We predict that this subject will be on the agenda for JCICS' golden anniversary issue, although new and different issues will most likely have emerged from the ever-changing technology.

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Abstracts and Other Information Filters

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Abstracts originated in order to provide scholars with a method to keep up with the fast growing literature. While they continue to serve this need, they, together with indexes, are indispensable tools in retrospective access in either printed or computer formats. A good informative abstract serves as a filter; its use eliminates the large volume of nonpertinent documents and retains those of most interest to the searcher. Other possible information filters have been suggested, but none has yet demonstrated the usefulness provided by abstracts. The abstract, or a future suitable substitute, is essential and cannot be abandoned.

Abstracting as a process for selecting or ignoring information is a literary form that dates far back in history with no recorded beginning, according to Skolnik.[1] In the 20th century this literary form has been perfected as a cutting tool for both alerting and accessing purposes in many scientific disciplines. Today it is estimated there are more than 1500 abstracting/indexing publications throughout the world in all areas

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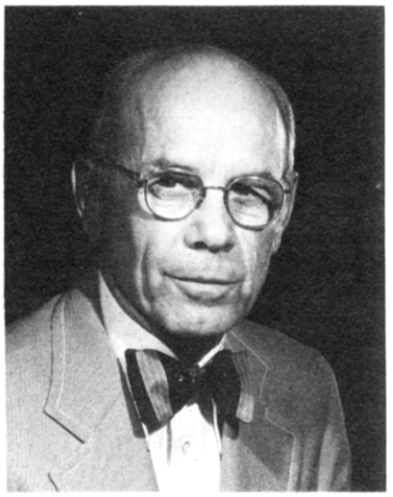

Russell J. Rowlett, Jr., received a B.S., a M.S., and a Ph.D. in organic chemistry, all from the University of Virginia. He was Editor of *Chemical Abstracts* (1967–1982) and Director, Publications and Services of Chemical Abstracts Service (CAS) (1979–1982). Before joining CAS, he was Assistant Director of the Virginia Institute for Scientific Research (1960–1967) and was with the Virginia-Caroline Chemical Corp. (now Mobil Chemical Corp.) (1952–1960), rising to the position of Director of Research and Developmment. Prior to that, he was a CAS Associate Editor (1947–1952), having begun his career as a research chemist with Du Pont in 1945. He is the author of about 55 publications on synthetic organic chemistry, antimalarial drugs, research administration, chemical nomenclature, information science, and abstracting and indexing. He has been the recipient of a Presidential Citation for research during World War II, the Distinguished Service award of the Virginia Academy of Science, the Board of Visitors Research award of the University of Virginia, the Miles Conrad Lecture award of the National Federation of Abstracting and Information Services, and the Herman Skolnik award of the ACS Division of Chemical Information.

of learned endeavor.[1] Since World War II, the rapid growth of scientific progress has multiplied the volume of scientific information published in primary journals and corresponding abstracts in secondary journals. The volume of scientific literature today is so large it can be addressed only via accessing tools of which indexes and abstracts continue to be the most efficient and most used.

Just under 12 000 abstracts were published by *Chemical Abstracts* (CA) in its first year, 1907. In 1984, nearly half a million were published. While it took CA 30 years to publish the first million abstracts, it now requires only two years to add a million abstracts to the total record.[2] This striking growth in the literature of chemistry is paralleled in other scientific disciplines. BioSciences Information Service now publishes 9 times as many abstracts as they did 25 years ago; Engineering Information, Inc., almost 10 times as many for the same 25-year period. Thirty-five members of the National Federation of Abstracting and Information Services (NFAIS) estimated they would publish a total of 4 321 450 abstracts in 1984.[3]

ABSTRACTS AS ALERTING TOOLS

The use of abstracts originated in order to provide scholars with a quicker and easier method of keeping up with the fast growing literature. This was an alerting function. Abstract journals obviously provided collections of abstracts in specific subject areas. Original papers in many primary journals carried abstracts following the titles as aids to readers in selecting those papers that they needed to read completely. Such author-produced abstracts were used with modification by the secondary services and thus extended the awareness of the original disclosure and of the journals themselves. Over the past 20 years, the Abstracting Board of the International Council for Scientific Unions has urged more primary journals to include good abstracts that can be used by the secondary abstract journals. Allan and Weil[4] have shown that of 85 important scientific journals published in 1950 only 45.9% included abstracts. In 1981 75.3% of the same journals carried abstracts. Although this is a small sample, the international effort appears to have been somewhat successful.

This use of abstracts in primary journals is clearly an alerting function. It calls attention to the complete paper that follows in the same publication. Similarly relatively small collections of abstracts in well-defined subject areas alert scientists to new work and to the journals that contain the reports. This was the stated purpose of the early abstract journals in the 19th century. It was the purpose of *Chemical Abstracts* born in 1907 out of the dissatisfaction American chemists felt with coverage of American chemical literature in European abstracting journals.[2]

For its first 50 years, *Chemical Abstracts* could be used as an efficient alerting tool. It was not too large to be "thumbed" regularly by interested scientists. Its Section arrangement by subdisciplines of chemistry aided such alerting uses. In the last 25 years CA has grown so large that its alerting value has declined. Groupings of Sections are still available, but these are often larger than an entire CA issue of 25 years ago. In recent years computer composition and storage have made possible the production of *CA Selects*, small subsets of narrow, well-defined subject areas with only 100–200 abstracts per biweekly issue. These at least restore the alerting use of small subsets from the very large data base. Abstracting services in other scientific disciplines are also providing subsets of their abstracts in similar fashion.

ABSTRACTS AS RETROSPECTIVE ACCESS FILTERS

It was an alerting need that abstracts first filled. While they continue to serve in this capacity, they now are indispensable tools in retrospective access. It is this retrospective demand that determines the long-term requirement of abstracts or a very suitable, yet to be developed, substitute. This access need is so large and so persuasive that future alerting uses can ride along as incidental benefits. The use of abstracts is the second step in well-planned retrospective access. The first step is thorough search of controlled index entries, which in today's environment retrieves a large number of potentially pertinent references. The abstracts corresponding to the retrieved references comprise the indispensable tools for efficient retrospective access. The uses of good indexes and abstracts go hand-in-hand. Neither is more or less important than the other, and both are needed for complete retrospective searching.

The abstract serves the same purpose as a porous filter in the chemical process of filtration. In a typical chemical filtration a large amount of solvent passes through a filter and is eliminated, leaving behind a smaller amount of valuable filter cake or residue. In a typical information search a large number of possibly pertinent references are found from a thorough index search. Review of the corresponding abstracts enables the searcher to eliminate the majority of the references and to retain the few that are most pertinent and should be read completely. The use of the abstracts parallels the process of chemical filtration. The abstracts help the searcher to retain the most useful document references and to eliminate the nonneeded documents from further consideration. In this sense the abstract serves as a filter.

The popular press in the field of information science is filled with predictions about the evolving information-transfer

technology. The demise of abstracts has been predicted by Kent,[5] who pictures the "re-establishment of the old-fashioned author-publisher-reader pattern of organization of information dissemination, using those terms in the widest possible sense." Further, Kent says "authors (the creators of information) and readers (the users of information) can be placed in direct contact with one another." Supposedly, the latter is to be accomplished via on-line terminals. Authors and readers in direct contact with one another is tantamount to a return to the 17th century when scientists wrote personal letters to one another describing their experimental results.

This latter prediction will not materialize. Kent is probably correct in stating "The opportunities that are being revealed for the capture, storage, retrieval, and dissemination of information by the silicon chip and its associated technology are such that it seems reasonable to say that if there is anything you want done it will be capable of being done by the year 2000." This technology will certainly speed access via abstracts to original documents, but elimination of the access tool in favor of full-text searching of the over 4 million documents covered by the NFAIS members annually, and over 10 million covered to date by Chemical Abstracts Service (CAS), does not appear practical or efficient. Some form of access filter, now exemplified by an abstract, will continue to be absolutely necessary.

The continuing value of abstracts as accessing tools was supported strongly in 1980 in a survey of 24 NFAIS member organizations.[6] Typical replies were "abstracts will continue to serve as the minimum units in acquisition of knowledge," "they are the least common denominator derived from journal articles at not too much cost in time and money", "we need some form of synthesis and condensation of the individual article," and "usefulness is not likely to diminish for years to come." Over the years abstracts have taken many forms and dimensions. What type of abstract is best suited for this continuing need as an access tool?

INFORMATIVE ABSTRACTS, THE BEST FILTERS

Types and variations of abstracts have been described by Borko and Bernier,[7] Rowley and Turner,[8] Weil et al.,[9] and others. The types have been categorized as informative, indicative, descriptive, terse, critical, and modular and by several other representations such as by whom written, by purpose, and by form. The type most useful for accessing purpose is categorized as informative.

A concise definition of a good informative abstract corresponds to the current standards of the American National Standards Institute (ANSI).[10] "A well-prepared abstract enables readers to identify the basic content of a document quickly and accurately, to determine its relevance to their interests, and thus to decide whether they need to read the document in its entirety." Weil[10] has stated that "an abstract should be as informative as is permitted by the type and style of the document." In 1970 CAS moved to a consistent "findings-oriented" abstract with a first sentence that is a brief statement of the major disclosures, results, and conclusions of the author.[11] Like the lead paragraph of a news story, this sentence is designed to let the reader know whether the subject is of interest. The abstract text that follows includes informative-supporting statements on methodology, reactions, activities, properties, and applications. Such an abstract in ANSI's words is "an abbreviated accurate representation of a document without added interpretation or criticism." Seventeen NFAIS member organizations who use abstracts adhere very closely to this ANSI standard. However, only one of these member services mentions the Standard in their statements of purpose or in their instructions for abstracting. Perhaps one way to encourage the use of good abstract standards would be to acknowledge those that are used.

Review[6] of the instructions for abstracting of 20 NFAIS members reveals almost unanimous agreement that an abstract provides only access to the original document that it attempts to describe. It is not a surrogate. It does not stand in place of, nor does it replace, the original document. It should not be the final source of precise or complete data. It is an accessing tool. Any investigator who repeats an experiment from only the instructions found in the abstract is doomed to failure and perhaps even to dangerous conditions. The abstract provides a rapid means for deciding whether the document is pertinent to professional needs. It identifies the basic content of the document and enables the reader to decide if the total document must be read.

Weil[12] recalled the early debates on the relative and absolute merits of journals of abstracts vs. bibliographic-reference-based indexes. He pointed out this controversy died down, and both types of access services have survived. However, the debate appears to be resurfacing as large amounts of index material becomes available on-line. Vendors of such on-line services are questioning why searchers cannot go directly from index entries to original documents. They cannot go directly because there are just too many documents retrieved in many searches. A filter other than index entries is needed, and the abstract is that filter.

The 10 years of the last two *CA Collective Indexes* (9CI and 10CI), 1972–1981, included 3 973 886 abstracts. Index entry points of all types for these abstracts totaled 42 902 253, including entries for general subjects, chemical substances, formulas, author names, and keyword phrases. These huge totals are growing annually by about half a million abstracts and another 5 million index access points. If it were possible to include all of the abstracts and index entries in the CAS files back to 1907, these very large numbers would double in size. These staggering statistics are just for chemistry. What would they total for the 35 NFAIS member services who create abstract and index services? Even the most carefully constructed search profile, limited in scope, will retrieve large numbers of potentially interesting references to original documents. A second-order filter, an abstract, is demanded to reduce these retrievals to manageable sizes.

Users have always been aware of the numbers of references included in the traditional printed services; however, they normally faced subsets of the totals in annual volumes or relatively small collections. Mentally, the large numbers were not so apparent, and human intelligence, sometimes unconsciously, weeded out the less important references. Today with the push of a button users can be inundated with thousands of answers to relatively simple questions. A typical 6-month *CA General Subject Index* includes almost 7300 entries at the single index heading Proteins, over 3000 at Wastewater Treatment, 2500 at Nuclear Magnetic Resonance, 2200 at Soils, and over 2000 at Blood Analysis. These numbers must be multiplied by 20 when a 10-year collection is searched on-line, and they continue to grow by more than 100% for each succeeding 6-month period. Certainly there are modifying phrases for some of the index entries, and logic, which in connection with associated subjects, can be used to reduce retrieval. However, the task is still formidable. The abstract is a most useful filter to reduce the retrievals to a manageable size, which makes for more efficient consultation of the original documents.

The full texts of many primary documents are now available in computer-readable formats and can be searched on-line. What does this portend for the future use of indexes and abstracts? Certainly some full texts are going to be searched on-line. However, when the total literature is considered, with its tremendous size and almost exponential continued growth,

indexes and abstracts will be absolute necessities and will themselves be consulted on-line. Even with very low-cost computer storage, the proportional differences in the sizes of files of index entries and abstracts vs. full text of documents are significant. On an approximate scale where the computer storage space for the average number of index entries for one document in the field of chemistry is established as one, the storage space for an abstract is two and for the full-text document is 40. The latter number does not include mathematical, tabular, and graphical material, which are not yet fully searchable via computer. The attractiveness of the abbreviated abstracts and index entries is obvious. Index entires are being searched on-line. In some systems the selected abstracts can be scanned or searched on-line. Then perhaps in the future the full documents can also be reviewed on-line. The keys to the documents that must be read fully will continue to be abstracts.

RETROSPECTIVE SEARCHING

The majority of retrospective searchers can be categorized into two relatively simple groups. The first group includes those who seek one, or a few, item(s) of data or fact(s) about a limited subject. Usually they are in a hurry and do not necessarily require the latest data, or all of the data. They do seek data in which they have confidence. Often they look for documents by a particular author, or from a specific laboratory or institution. They proceed rapidly from a few index references to an equally few abstracts. They select the one or two original documents in which they confidently expect to find the data they seek. Examples of such searches in chemistry include a quick method for preparation of a substance, a numerical property, quantitative data on a use for a substance, and a result from a specific investigator.

This group comprises many who ask why abstracting and indexing services cannot provide "the actual data" directly without the searcher having to read the original documents. The answer is inherent in the manner by which these searchers approach the files. They have a built-in mental evaluation that defines their searches by author, language, institution, and even appraisal of the index entry as they read it. Thus, they locate rapidly the data that fits their individual parameters. In essence, they evaluate the data while they search. This is a feat that the abstracting and indexing services cannot accomplish beforehand and package individually. A service cannot anticipate exactly which data will be most important and highlight it or predetermine its value into the future as additional studies are completed on the same or similar subjects.

There is a second reason why abstracting and indexing services cannot alone provide "the data". Their staffs have thorough subject backgrounds and expertise, but they are separated from actual current research and technology. They are not conversant with day-to-day developments in a research environment truly on the cutting edge of a subject. To perform data analysis, to be in a position to select "the best data", one has to be in such an up-to-date research atmosphere. An isolated abstracting and indexing staff cannot do this. However, such a staff could lead a searcher to where "the data" might be found in an operating data analysis center. Via computer networking, actual data could be retrieved from the analysis center's files and transferred to the searcher via the abstracting and indexing service. Discussions of such cooperative data supply have been initiated in a few cases.

The second group of retrospective searchers are involved with truely comprehensive assignments. They seek large amounts of information on subjects with which the searcher is not very familiar. Such searches comprise literature studies that precede new research programs, state of the art reviews, prior art patent searches, exhaustive studies for whatever purpose. They involve the literature from many previous years, perhaps as far back in time as the particular subject has been reported. It is in such searches that the informative abstract performs its greatest service. It provides the best filtration by removing a large volume of less relevant references and leaving a smaller, more manageable, residue of pertinent references. It is here that the abstract, or a future suitable substitute, is essential and cannot be abandoned.

Cremmins[13] emphasizes the value of abstracts and suggests that since the secondary publications and services that carry abstracts have become better known as access publications and services, the abstracts prepared by them should be referred to as "access abstracts". This is an appropriate term. Abstracts that have filtered out the large volume of nonpertinent references do indeed provide access to the small number of references that must be consulted thoroughly.

OTHER INFORMATION FILTERS

Are there filters for hugh volumes of information other than abstracts? A few have been proposed; none appears to have established a foothold as yet. It has been suggested that some forms of indexing come close to abstracting.[6] Low-cost computer storage may eliminate the constraints of the printed page, and future index entries may include one or two sentences, a mini-abstract. The filtration step will continue as part of the review of the index entry. While such future index entries may be quite different from those we see today, there are examples in current indexes that are almost one-sentence abstracts. These in no way replace the abstract but they illustrate the future potential. The following four examples are from recent CAS indexes.

Soups
carrot, nutrients of, infant diarrhea treatment in relation to

This entry was derived from the thought "Infant diarrhea treatment in relation to nutrients of carrot soup."

Behavior
locomotor
lead effect on, of newborn, after maternal administration, brain development in relation to

This entry as a continuous idea is "Effect of lead on brain development in relation to locomotor behavior in newborn after maternal administration."

Plastics
anticorrosive and waterproofing insulation for construction, development prospects for, in Poland

This entry came from the thought "Development prospects in Poland for plastics as anticorrosive and waterproofing insulation in construction."

Stars
birthrate and initial mass function of, in solar neighborhood

Finally, an entry from the stars that originated from the phrase "Birth rate and initial mass function of stars in the solar neighborhood."

A technique has been developed by which these one- and two-sentence ideas can be input to the computer and converted automatically to several appropriate index entries.[14] The process has not been implemented operationally but has been tested and shown to be cost effective. It is conceivable that full sentences may be expanded and/or improved via the computer to serve in a manner similar to today's abstracts but actually incorporated within index entries. The availability today of index entries on-line in approximtaely the same time frame as the full abstracts does provide an opportunity to study their use as an alerting function. In an actual test,[6] the use of a listing of all index entries from a given document in lieu

of the corresponding abstract was deemed entirely inadequate. This result may have occurred because the current phrases accompanying the index entries are not detailed enough to suggest all of the connections contained in the document and the corresponding abstract. Also, inverted index entries are sometimes difficult to interpret quickly and overall understanding is complicated by the redundant nature of multiple index entries.

Most documents require multiple index entries to fully describe their total significant contents. For example, the document on plastics in Poland may also describe development prospects for synthetic fibers for purposes other than construction. An expanded index entry at the alphabetical heading Plastics would provide a mini-abstract for only this specific part of the document's content. It would not indicate that the document also deals with synthetic fibers. This problem probably only exists for printed services. In on-line retrieval, presumably, if one interesting index entry is located all other entries for the same document can be displayed on the screen. While today's index entries do not appear to constitute an acceptable abstract, expanded entries with short sentences might provide the filter that is needed so badly.

Experiments have been conducted on having the computer select significant representative sentences from a document and construct a usable abstract. Borko and Bernier[7] concluded in 1975 that the computer could select sentences, but the result was not really an abstract, merely an extract. The assimilation of several ideas from a single document and the creation of an understandable abstract, representative of the whole document, is still an intellectual process performed best by humans.

Titles plus bibliographic citations serve as very rough information filters in a few areas of science. They seem to be adequate only where the subject is very narrow or where the work of an individual and/or an institution is being followed. Obviously when the volume of literature is huge, as the above illustrations, these filters are entirely inadequate. The most successful example of this type filter is the multidisciplinary *Science Citation Index* (SCI) produced by the Institute for Scientific Information (ISI). SCI indexes documents from over 2600 journals representing more than 100 disciplines. Three types of indexes are available. The *Science Citation Index* permits a searcher who knows one or more authors who have published in a particular field to locate references that cite the previously known work. This leads to a chain of related references on the same or similar subject. It is a useful filter only when authors continue to work in the same field over a reasonable period of time, for example, in physics.

The *ISI Source Index* is an alphabetical listing of authors and organizations. The *Permuterm Subject Index* pairs or couples together all the significant words in the titles of the documents covered in the service. Both of these filters suffer the limitations pointed out previously for titles and bibliographic citations.

Several suggestions have been made for modification of the present format for informative abstracts.[6] If abstracts are the best filter for information, can the filter be improved? The format employed by most current services is essentially the same with which the services began operations 50–70 years ago. Suggestions have included an abstract with all "excess words" removed: the bibliographic citation plus a listing of all corresponding index entries; a one-sentence summary abstract; and a terse mini-abstract. Only the latter has received any favorable acceptance and deserves further study. The idea of terse sentences and expressions has been described by Bernier.[15] From an operational standpoint, production of the mini-abstract format will be more costly in analysts' time than production of the current format. More importantly, it appears that the mini-abstract while satisfactory for alerting purposes may not fit the criteria for a useful filter in retrospective searching. Here the abstract must provide sufficient information to enable the searcher to decide if the original document must be consulted. The mini-abstract may be too brief for this important purpose.

In studying new shortened formats for abstracts readers appear to be apprehensive and misunderstand any change that employs less than complete sentences. It may be the nature of human comprehension that only full sentences, properly formulated, are easy to grasp quickly and retain. Searchers may in time grow out of this state but are not yet ready to accept telegraphic style in their main information sources.

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