



# Indexing, Abstracting, and Translation Services

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OF ALL TYPES OF SERIAL PUBLICATIONS, none is more cosmopolitan and none more urgently needs coordination and possible unification than those known as "services" since they are, in effect, the keepers of their brothers. An examination of United States indexing, abstracting, and translating services and their trends requires, by the nature of these publications, a comparison with present and past accomplishments by other countries in this area of bibliographic concern.

In recent years more and more attention has been focused upon serial services including an important survey of the background and inherent problems of these publications as well as a historical review of abstracting and indexing services for serials.<sup>1, 2</sup> A review of the relative usefulness of 6 science services also produced some interesting comparisons in coverage.<sup>3</sup> A more recent study of the problems and developments of abstracting and indexing services was recently published as part of the series *The State of the Library Art*.<sup>4</sup>

As pointed out by Shera and Egan in 1950,<sup>5</sup> there is no centralized bibliographic service supported by the United States comparable to the system established by the Federation Internationale de Documentation. The International Conference on Scientific Information held in Washington, D.C., in 1958 drew attention to the urgent need for international cooperation and to the necessity of developing new concepts to cope with increased publications in many languages. UNESCO has been instrumental in the progress made in the bibliographic areas of the natural sciences and particularly by the humanities, where serious inequalities existed ten years ago. However, during this past decade such huge quantities of information have been published that it has been impossible for research workers and teachers to keep up with their own subjects. Experts in several areas have noted

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that confusion is on the increase, and in this respect, the situation is worse than it was 10 years ago because mechanical and electronic methods for information retrieval and storage have not developed to a point where they could be put into general use.<sup>6</sup>

Major undertakings of indexing and abstracting services have been the work of special groups and organizations, e.g., the American Chemical Society, producing *Chemical Abstracts*; large and special libraries, e.g., *Public Affairs Information Service*, issuing from the New York Public Library, and the *Bibliography of Agriculture* prepared by the U.S. Department of Agriculture Library; and commercial ventures, e.g., the H. W. Wilson Company and its various services.<sup>5</sup>

Since this paper is largely concerned with the past decade or so, mention should be made of the International Conference on Science Abstracting convened by UNESCO and held in UNESCO House in Paris, June 20-25, 1949. At that time the International Federation for Documentation prepared, with aid from UNESCO, a *List of Current Abstracting and Indexing Services*,<sup>7</sup> the initial attempt toward preparing a guide of indexing and abstracting services primarily in the areas of pure and applied science. The same year also produced a statistical analysis of scientific abstracting and indexing services in terms of coverage and composition.<sup>8</sup> Another outcome of this conference was a report<sup>9</sup> for discussion at meetings in 1950. Although many recommendations were made which were not carried through, the survey did reach the conclusion that only in terms of national units is a universal bibliography possible.

With this idea of creating a basic bibliographic structure and delineating an ultimate goal in the area of services, the decade produced buoyant hopes. Moreover, these hopes were heightened with the reconsideration of the old problems of time lags and coordinated coverage in terms of the development of such technological advances as electronic computers, advanced photographic techniques, rapid selectors, peek-a-boo systems, and machine translators.

The amount of use of serial publications logically is a determining factor in the relative importance and degree of development of indexes and abstracts. Conversely, the number of indexes and abstracting services might determine use of serial literature. Research in American history points to about 9 per cent use of journals and 12 per cent of newspapers according to a survey by McAnally.<sup>10</sup> According to Fessler,<sup>11</sup> in the United States chemists and physicists use serials for over 90 per cent of their references.

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However, the greater reliance of fields outside the natural and physical sciences upon material other than serials seems to point up an inadequacy in indexing-abstracting services in such areas as humanities and social sciences. Librarians in these latter fields have expressed a particular need for retrospective indexing.

Synonymous with indexing and bibliography in general is the name of Halsey Wilborn Wilson. The *Cumulative Book Index*, *Reader's Guide to Periodical Literature*, *International Index*, and *Agricultural Index* illustrate a wide range of subject area coverage. The evolution and development of these indexes and the other H. W. Wilson publications are chronicled in Lawler's volume on the Wilson Company, which also gives a résumé of the origin of the "service basis" charge as well as subscriber participation in the selection of titles to be indexed.<sup>12</sup>

A significant change in Wilson services occurred in 1957 and resulted from a study conducted by the Committee on Wilson Indexes. The subscribers to the *Industrial Arts Index* voted to divide that *Index*. Thus, in 1958 the *Applied Science and Technology Index* and the *Business Periodicals Index* came into being. Such amoebic action can be fairly well explained by the growing number of subject journals in almost all fields, creating a need for additional approaches to more limited subject fields. Voting by subscriber for inclusion or rejection of a title in a Wilson service continues as does a regular analysis of what is being indexed.<sup>13, 14</sup>

The division of one index into two at the general level shows what is occurring in a more concentrated way on the research plane, particularly in the physical and natural sciences. The economics of such concentration are evident, since it sometimes becomes necessary, because of this specialized splintering, to purchase two services where one had been sufficient.

Price increases for service publications in all major areas have risen sharply in the past ten years. A cost index<sup>15</sup> covering the following areas of Business, Law, Miscellaneous, and U.S. Documents from the base period of 1947-49 to 1960 indicates the following increases:

|                | 1947-49<br>Average<br>Price | • Index | 1960<br>Average<br>Price | Index |
|----------------|-----------------------------|---------|--------------------------|-------|
| Business       | 63.43                       | 100     | 85.00                    | 134.0 |
| Law            | 16.82                       | 100     | 33.55                    | 199.4 |
| Miscellaneous  | 13.75                       | 100     | 31.38                    | 228.2 |
| U.S. Documents | 6.21                        | 100     | 19.68                    | 317.0 |

The erratic price fluctuations of cover-to-cover Russian translations prior to the subsidy programs now operating have prevented inclusion in the cost index.

In order to obtain an idea of the percentage of services being issued from commercial, society, and government sources, a count was made of titles in the National Federation of Science Abstracting and Indexing Service publication, *A Guide to U.S. Indexing and Abstracting Services in Science and Technology*.<sup>16</sup> The 492 titles consist of 188 in medicine; 145 in technology; and the remaining 159 in 8 other classes. Three hundred ninety-three of these are abstracting services, and 99 are indexing services. Of the 492 services, 250 (approximately 50 per cent) were issued by commercial organizations such as the H. W. Wilson Company, Pergamon, Interscience, or industrial firms. One hundred ninety-two titles (approximately 40 per cent) were issued by societies, foundations, or scholarly institutions—some of which might be financed to some degree through government funds, but here the emphasis is upon the origin of the work itself. The U.S. government produced 50 titles (approximately 10 per cent).

While such a breakdown is possible with indexing and abstracting publications, in translation services there is frequently a combination of commercial organization, society, foundation or scholarly institution, and government. The commercial organization provides the mechanics of getting the material into print and distribution. Also, a commercial group, such as Consultant Bureau, may be commissioned to translate and publish certain journals for a learned society, which, in turn, handles subscriptions for the titles it has selected for translation. According to the 1960-61 *Catalog* issued by Consultant Bureau, the Bureau is presently translating 18 journals on behalf of learned societies.

The 1961 edition of the *Pergamon Press General Catalog* states that the Press prepares verbatim translations from advance proofs obtained through special arrangements with the Academy of Sciences of the U.S.S.R. and other organizations. It was issuing at that time 17 translations of journals, only 3 of which are the initiation of Pergamon; the others were being published on behalf of scientific societies and supported financially largely by the U.S. National Science Foundation and other government agencies.

In August 1960, the National Science Foundation published a list of 85 cover-to-cover translations of Russian journals; the "list" published in August 1961 cites 126 titles. The first translation period

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covered was in 1948; however, over 75 per cent of the 126 titles listed in 1961 covers the period beginning in 1957 or later.<sup>17</sup> It is most likely that cover-to-cover translations will continue to increase since it is generally agreed that it takes about 5 years for a technical periodical to attain its normal pattern of circulation. Over 80 per cent of the translated editions have been running less than 5 years.<sup>18</sup>

Early in the 1950's interest in machine translations (MT) began and received nourishment from the conference on MT held in 1953 at the Massachusetts Institute of Technology. The IBM-Georgetown experiment in translating selected Russian sentences into English increased in momentum the exploration of the possibilities of machine translating.<sup>19</sup> Mechanical translations run about 1,000-3,000 words per hour and eventually may run 1,000 words per minute.<sup>20</sup> Although the development of the electronic computer promises revolutionary changes in MT, there are presently strict limitations upon its use which is primarily geared to the exact languages of the sciences. In a lexical sense there is still much to be done.<sup>21, 22</sup>

At present our major translating difficulties involve the Russian language. Perhaps the basis of all our problems rests in a lack of scientific education for those who major in the humanities and a similar failure in linguistic education for those whose educational forté is science. The on-the-spot translator who can give the scientist a brief run-down as to the contents of a paper is a decided asset.<sup>23</sup>

As a general rule, technical and scientific users are not interested in full translations but in abstracts or subject reviews of the papers in their particular field.<sup>24</sup> In the short time that the translation problem has been explored, more progress has been made toward its solution than has been made for finding our way out of the morass of abstracting and indexing complexities. To some degree the *Index Translationum*, *ASLIB Index of Unpublished Translations*, and other such sources are of help but have definite limitations.

Another translation service began in 1954, *Chartotheca Translationum Alphabetica*, an alphabetical index of translations which will appear on cards each month and have a bound cumulated volume at the end of the year. The volume for 1961, which will appear in March 1962 according to the publishers, will contain 18,000 titles with 5,000 cross references. Emphasis upon the period covered centers around 1955.

Major points of stabilization for translation information are the Special Libraries Association Translation Center located at the John

Crerar Library in Chicago, and the Office of Technical Services in the Department of Commerce, Washington, D.C. These two points, working in conjunction with each other, serve as the principal translation depositories in the United States. The S.L.A. Translation Center acquires those translations issued by nongovernmental sources including industry, professional societies, universities, etc. The O.T.S. Technical Information Division obtains translations produced by government agencies as well as selected foreign governments, primarily Great Britain. The two centers reciprocate by distributing to each other copies of those translations which they receive. Listings of these translations, along with abstracts of them, appear in the semimonthly publication, *Technical Translations*, which began in 1959. It is published by the O.T.S., which incorporated the Special Libraries Association publication, *Translation Monthly*.

The John Crerar Library will be a central source for about 10,000 complete translations to be collected and distributed annually by the Office of Technical Services. In addition to the need to expand our program of documentation centers on an international level, there is the need for an international list of published and unpublished translations.<sup>25</sup>

Translation of Russian material on an extended scale is uneconomical and, at best, a stopgap procedure until our language curricula at the high school and college levels can eventually solve the problem.<sup>26</sup> The American translation of a Russian journal costs about \$25.00 per Russian page including production and distribution costs; comparable British cover-to-cover translation runs about 7 pounds, or \$20.00. The translating cost itself amounts to about 13 per cent of the overall cost. As production know-how is gained, costs may be expected to decline, and the present time lag, which now varies from 6 to 9 months, reduced.

The American translation receives about 10 per cent of its support from subscriptions, while England supports about 20 per cent through subscriptions. The average subscription list runs about 250 both in the United States and England, with the exception running as high as 1,000 for a British translated item.<sup>27</sup>

In addition to our access to Russian and East European material through the medium of translation, the past decade has seen bibliographical services enriched by such publications as the *Monthly Index to Russian Accessions* and the *East European Accessions List*, both issued by the Library of Congress.

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Scientific societies also play a role of varied responsibilities in service publishing. In addition to the publication of specialized journals containing abstracts, they are ever active in organizing and assisting the many abstracting services, outlining and defining specific needs, and stimulating thought toward filling in gaps in the coverage of a variety of subject areas.<sup>28</sup>

In the social sciences and humanities the activity in service publication is not as great as it is in other subject areas. One factor largely influencing this is the immediacy with which material is needed. In his analysis of the *American Sociological Review*, Broadus found that 73 per cent of serial references in sociological writings came from work published during the previous ten years.<sup>29</sup> This use differs considerably from the needs of laboratory research in the physical and natural sciences, which requires immediate information as to what may be taking place in some laboratory on the other side of the world.<sup>30</sup>

In 1948 the Carnegie Corporation gave a grant to the Graduate Library School and the Division of the Social Sciences of the University of Chicago to finance an investigation into "the desirability and feasibility of an abstracting system for the social sciences."<sup>31</sup> The investigation revealed that a wide range of disjointed services was being published in which some fields of the social sciences were adequately covered by such publications as the *Public Affairs Information Bulletin*. Other specific areas were served by *Psychological Abstracts*, *Child Development Abstracts*, *Population Index*, *Education Index*, *Review of Educational Research*, *Agriculture Index*, and *Bibliography of Agriculture*. The survey concluded by proposing, among other things relative to correction of overlapping and existing gaps in service coverage, the establishment of two self-supporting services: "(1) a series of bibliographical review articles issued as separates, and (2) a system of selective abstracts for economics and for sociology-anthropology-political science."

These recommended self-supporting services have not appeared, but the area has been increased in coverage by *Sociological Abstracts* which began in 1952 covering 5 periodicals fully and 2 partially. Its ultimate goal, as cited by the editor, is to expand this publication to cover the sociological literature of the world. The July 1960 issue shows that a degree of expansion has taken place: 13 journals were abstracted fully and 51 partially.

In 1959 scholars in the social sciences in general and anthropology

in particular were given more ready access to the *Human Relations Area Files* which were developed from the program of the Institute of Human Relations of Yale University. This development resulted from action on the part of the Social Science Research Council assisted by the Carnegie Corporation in cooperation with 18 American Libraries which are depositories for this continuing flow of indexed material from published and unpublished sources.

Service coverage of commerce and business publications is wide and varied. W. Hausdorfer<sup>32</sup> cited 776 services based upon the definition used by the Special Libraries Association. A supplement to the *Handbook* published in December 1958 listed 49 more.

Commerce services appear in many forms and constitute some of the most expensive published in the United States by such firms as Standard & Poor's, Moody's, Commerce Clearing House, Prentice-Hall, and National Research Institute. In addition to the impressive financial services exemplified by the first, there are the highly competitive, loose-leaf publications issuing in a nervous stream from Moody's, Prentice-Hall, and Commerce Clearing House, plus "newsletters" and "reports." To generalize, the vast network of services available in the field of commerce falls into the following major categories: advisory and interpretative, factual business information, investment services, credit services, and management consultation.<sup>33</sup>

Law services follow a pattern similar to those for commerce and business, with Prentice-Hall and Commerce Clearing House joining forces with West Publishing Company, Shepard's Citations, Inc., and others to keep the field growing with services. Perhaps the compulsory cooperation exacted by government regulations and other government controls on business accounts for the constantly expanding market for these services. Pocket parts and advance sheets are a major concern in the field of law services, covering changes and revisions with a rapidity not present in other subject areas in need of up-to-date information. However, the coverage of law periodicals by standard indexes is not as comprehensive.

A major source of statistical information is the large number of federal periodical statistical publications. The revised edition of *Statistical Services of the United States Government* for 1959 lists 220 sources issued by 66 agencies, almost a 100 per cent increase over the 125 sources listed in the 1952 edition. Although the government does not have a centralized statistical organization, all government statistical resources with their complexity, variety, and vast scope are coordinated through four major agencies.<sup>34</sup>

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Coverage in the field of library science and documentation literature suffers from the blemish of overlaps and gaps. This matter has been surveyed by Helen L. Brownson,<sup>35</sup> and while the journals selected and examined reflect the "documentalist" point of view, those areas of primary interest to "library scientists" are also much in evidence. The study shows that the library field in general has not achieved an ideal situation.

The duplication of abstract coverage is comparatively slight, but still no one service is completely covering this relatively limited field. This lack may be accounted for by the fact that there is no semantic agreement as to what the term "documentation" covers. The law of "scattering" is therefore evident to some degree, although it is not as prevalent as in the physical and natural sciences.<sup>36</sup>

The peripheral aspects of subject matter present inherent problems especially difficult to solve. *Psychological Abstracts* duplicates to some extent the physiological and neurological material found in *Biological Abstracts* and also some of the material covered by *Sociological Abstracts*.

In 1949 there were 6,530 entries in *Psychological Abstracts*. In 1954 there were 9,120 entries, or a 55 per cent increase reported by the editor.<sup>37</sup> In 1955 B. Glass in his survey of *Biological Abstracts* pointed out that almost two-thirds of the entries under "animal behavior" for articles published in 1950 were omitted from *Psychological Abstracts*. To correct this defect in coverage, page limitations of material already being abstracted were necessary because of budgetary restrictions. This dilemma of restricted finances and of more material requiring abstracting or indexing is being faced daily by many services. *Biological Abstracts* has increased its coverage about 100 per cent since 1950. Yet the Glass survey of *Biological Abstracts* revealed that of the estimated 22,000 current journals of interest to biology published in the world, only 10 per cent were covered by this service.<sup>38</sup> Each journal published an estimated 70 to 75 articles a year, figures which projected mean that about one and a half million articles on biology were produced in 1955.<sup>39</sup> However, the Director of *Biological Abstracts* felt that only about 3,500 to 4,000 journals were devoted to the publication of original research, and more recent studies in 1957 indicate that, exclusive of chemical medicine, there were 155,000 research articles with an annual growth rate of between 7,500 and 10,000 articles each year.

Even if one uses the revised figures, the leading service publication

in biology in the United States still covered only about 26 per cent of the total literature, or about 40,000 abstracts. In 1956 *Biological Abstracts* developed a ten-year plan providing for a gradual increase in coverage each year so that 80,000 abstracts will be published by 1966.<sup>40</sup> An important assessment of the total problem of abstracting, indexing, and translating in 1960 cited a figure of 30,000 journals publishing original papers in biological research producing 1,500,000 articles per year.<sup>41</sup>

*Chemical Abstracts*, the most exemplary of United States services, covers over 8,000 journals and 150,000 articles and patents. In 1960, 140,000 abstracts were published—a 12 per cent increase over 1959; in 1961, it is planned that 155,000 abstracts will be published, or 11 per cent more than in 1960.<sup>42</sup> In place of the decennial index, it is now planned to publish a 5-year index as soon as the last volume of the 1947–56 index comes off the press in 1962.

A survey of abstracting and indexing services in engineering was made in 1955 by the Engineering Section, Science and Technology Division of the Special Libraries Association. At that time 231 abstracting services were recorded in 15 special fields and the field of general engineering.

The major drawback of this type of coverage is that it is costly and perhaps unnecessarily extensive.<sup>43</sup> The paragon in the field, *Engineering Index*, which contains annually about 20,000–30,000 brief abstracts, has remained solvent largely because of efficient organization, coverage of around 1,400 journals received without cost, card service permitting short time lag, service charges remaining reasonable, and ease of use. Another point of view is found in a survey made by Massachusetts Institute of Technology of coverage in the field of electrical engineering.<sup>44</sup> About 160 primary United States and foreign abstracting and indexing services cover the field.<sup>45</sup>

The Welch Medical Library Indexing Project, completed in 1953, studied over 6,000 serials in relation to their coverage by 37 indexing and abstracting services.<sup>46</sup> At the Annual Meeting in 1956 of the Medical Library Association, a symposium explored this matter further.<sup>47</sup> The findings showed that of the 27 per cent of the journals not covered by the *Quarterly Cumulative Index Medicus*, *Current List of Medical Literature*, or *Excerpta Medicus*, 14 per cent were listed in *Chemical Abstracts*, *Biological Abstracts*, or both, with *Psychological Abstracts* covering the remainder reasonably well.

The most recent development in medical services, grounded in a

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decade of planning, was carried out with a grant from the Council on Library Resources in April 1958 to survey indexing procedures and develop a mechanized operation. In 1959 *Q.C.I.M.* was amalgamated with *Current List of Medical Literature* resulting in the publication *Index Medicus*. This new publication utilizes the mechanical functions of a typewriter operating from punched tape, IBM sorters and collators, and the Eastman-Kodak listomatic camera, able to photograph 230 IBM cards a minute.

In physics during the past 10 years or so the field has grown five-fold, and its 150 abstracting services are unable to cover the literature completely. As of 1961 the American Institute of Physics was publishing 15 journals, and in addition translating 8 Russian journals with the support of the National Science Foundation. The International Council of Scientific Unions Abstracting Board founded at the UNESCO Conference on Scientific Abstracting in Paris, 1949, is still exploring the possibilities of a single physics abstracting journal.<sup>48</sup>

The physical sciences and engineering services run a wide gamut in coverage, as well as in quality of abstracts and subject indexes.<sup>49</sup> Among the science services upon which greatest reliability is placed are *Chemical Abstracts*, *Applied Mechanic Reviews*, *Engineering Index*, *Nuclear Science Abstracts*, *Physics Abstracts*, *Mathematical Reviews*, *Electrical Engineering Abstracts*, and *Technical Abstract Bulletin Indexes*.

A summary<sup>50</sup> of the recommendations and results of the international conference (1948-1950) on scientific information and bibliographical services and a compilation<sup>51</sup> of the UNESCO reports by Ditmas contain much that is as valid in 1962 as it was in 1948 regarding gaps and overlapping, the need for a cost analysis of the economics of abstracting, and the development of techniques for preparing and issuing abstracts.

Lack of general agreement as to what is essential in the way of abstracts and indexes for science and technology or how comprehensive coverage should be has dissipated energies and resulted in fragmentation of services. However, largely through government and foundation support, progress is being made. The Ford Foundation, National Science Foundation, and the work of the Council on Library Resources are encouraging other financial and intellectual forces to join hands in solving the problems of storage and information retrieval. Nevertheless, there still is a need for a single guiding group or council of coordinated guiding groups. On the basis of organization the pres-

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ent status of indexing and abstracting services is little better than it was ten years ago; from a technological point of view, it has grown.

Other basic elements lacking at present are precise methods of achieving standardization of terminology and a clear delineation of purpose, cooperation and coordination between existing services as well as development of future services or modification of present services through a central organization at the national level, and the systematic development of mechanized operations through this central organization. Only a small start has been made in educational programs for librarians as to present trends in general documentation and information retrieval programs, and this will probably develop and expand as part of the education for librarianship.

In the past 5 years the National Science Foundation in conjunction with member scientific societies and representatives of the larger United States abstracting and indexing services has organized the National Federation of Science Abstracting and Indexing Service. This group is seeking ways to close gaps and extend coverage and is attempting to expand existing services by helping financially to prepare cumulative indexes and eliminate backlogs.

The establishment of the National Science Foundation in 1950 was a most effective stimulus to solving some of the existent bibliographical problems. A comparison of the 31-page *Annual Report* for 1950-51 with the 310-page 10th *Annual Report* for 1960 is a significant gauge of the advance made in 10 years in the areas of abstracting, indexing, and translating research programs.

To keep pace with the rapidly changing science scene, the National Science Foundation issues *Current Research and Development in Scientific Documentation* each May and November. This series reports on studies in the various areas of scientific documentation.

The National Science Foundation in 1959 assumed the responsibility for development of and leadership in the area of scientific information in the United States. As coordinator of such activities, it is assisted by the Science Information Council, established in December 1948 by the Foundation. Members of the Council are representatives of professional societies, education, private industry, and government, as well as others involved with information problems.

The Federal Advisory Committee on Scientific Information has developed a program of translation of scientific literature overseas for the use of government scientists in line with extension of the Agricultural Trade Development and Assistance Act of 1954 (P.L. 480)

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as amended in 1958 which permits overseas translation programs to be financed with foreign currencies due the United States for the sale of surplus agricultural commodities abroad.

The National Science Foundation grants in the translation area have stepped up considerably in the past several years. The American Institute of Biological Sciences, the American Institute of Physics, the American Society of Mechanical Engineers, the National Academy of Science, and the National Research Council are among those institutions cited in the 1960 *Annual Report* of the National Science Foundation as receiving funds for extensive translation activities. Many other learned societies are receiving funds from the Foundation to prepare and publish cumulative indexes and bibliographies, among them being a grant for continued expansion of coverage of *Biological Abstracts* at the University of Pennsylvania. *Acta Metallurgica* is also receiving funds.

The patchwork relationship of our present abstracting system and the cost of making a thorough search were rather pointedly expressed by F. T. Sisco, the vice president for research of a large corporation, referring to the efficiency of *Metallurgical Abstracts* with the statement, "If a research job in the U.S.A. costs less than \$100,000, it is cheaper to do it than to find out if it has been done before and is reported in the literature."<sup>52, 53</sup> Modification of this statement might be necessary in several subject areas, but a goodly portion could stand as a verbatim indictment of a situation suffering from duplication in some instances and glaring gaps in others. Perhaps the Russian publication *Referativny Zhurnal*, which was begun in 1953, is the nearest approach to a type of abstracting service providing a single source for several fields. It is comprised of sections covering 13 subject areas, international in scope, and is a source for many of the abstracts appearing in U.S. abstracting services.

A count of the number of times a title is covered by a service and how many are not covered in almost any of the subject areas in *Ulrich's Periodicals Directory* will illustrate this point. As a sign of the growing importance of "services," the 1959 edition lists for the first time in a separate section 241 of these publications.

Earlier attempts to maintain a current listing of serial services have failed both on a national and international level. Theodore Besterman's revision of *Index Bibliographicus*, published in 1952 by UNESCO, opened a new vista in this important bibliographic area of abstracting and indexing services. This third edition contained over

3,000 services covering science, technology, social science, and humanities, and is useful for a retrospective review. The fourth edition is in process. The first volume, "Science and Technology" was published in 1959 under the co-editorship of the International Federation for Documentation and ASLIB. This volume contains about 1,800 titles which, as might be expected, exceed the number in this area cited in the third edition. The second, third, and fourth volumes will cover "Social Sciences," "Humanities," and "General Bibliographies" respectively. The total coverage will be considerably greater although still on a selective basis. There is still a strong need for a comprehensive, international list of services which can be maintained on a current basis.

One solution to the problem of an up-to-date way of controlling holdings and location of serial publications is in process—a third edition of the *Union List of Serials*. This in conjunction with the Library of Congress publication, *New Serial Titles* (formerly *Serial Titles Newly Received* in 1951–1952), and the use of a mechanized system of bibliographic reproduction will bring some order to a situation fast getting out of hand. However, this is but a small phase of the overall problem and does not affect directly the pressing need for a coordinated indexing and abstracting service.

Another growing problem concerns a need for bibliographic control of United States government research reports, which, with the exception of *Nuclear Science Abstracts*, are covered only slightly by other abstracting services.<sup>54</sup> The availability of many series of Government Research Reports is made known through the *Monthly Catalog of U.S. Government Publications*. In addition to this, those Reports distributed by the Office of Technical Services are cited in *U.S. Government Research Reports* which is issued twice a month, carries about 2,000 entries per year, and includes abstracts of about 100 words. This is, however, certainly not an exhaustive and systematic coverage of the total body of Government Research Reports done by a vast variety of agencies, governmental and nongovernmental, on a contractual agreement. The extent and degree of coverage of this type of publication present a growing problem in information retrieval. The quality, the ephemeral nature, and the inability of existing services to keep pace with conventional forms of publications have militated against their coverage.

Estimates of the number of serials in science and technology range from 50,000 to 100,000, and new journals probably appear at the rate

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of two or more a day. These journals are published in more than 60 languages, and it was estimated in 1960<sup>55, 56</sup> that the year's output of material in scientific and technical journals would possibly reach two million articles, or three times as many as appeared in 1940.

Rapid selectors, peek-a-boo coding, and minicards are but a few of the approaches to the problems of abstracting and indexing which must be resolved if any semblance of the traditional orderliness of the library world is to be maintained. An example of the practical application of machine techniques can be found in the new service, *Chemical Titles*, which will be prepared from an IBM 704 computer. This machine will analyze, index, and print directly by photo offset from the computer.

Machine retrieving is already being used by many industries and research laboratories. However, it has not been established as a regular piece of working equipment to which libraries, in general, have access. In this regard it remains only an "ideal" way to relieve the burden of controlling print. How the machine will help still produces some fuzzy answers, particularly since the sophisticated systems now being developed can run into millions of dollars—far beyond the accepted budgetary thinking of the general librarian.

It is only within the past several years that manufacturers of computers have really turned their attention to information retrieval. This fact is heartening, for it may mean machine control applicable to libraries could appear during the next decade.

How much would it take to finance the organization and operation of a central agency for the coordination of abstracting, indexing, and other information retrieval operations? Chamberlin has set the figure at \$283,350,000 as the annual budget for the operation of an international institute for scientific information, a figure which he admits is a starting point from which some refinement may be necessary.<sup>57</sup> In his outline for the establishment of such an institute, consideration is given to the fact there are no exact cost figures available for the present unintegrated and uncoordinated operation. Of the approximately 3,500 abstracting services in the world the average cost is estimated to be not less than \$50,000; *Chemical Abstracts* costs almost \$1,300,000; and as many as twenty industrial organizations spend close to \$100,000 a year on abstracting.

A survey of 2,000 special librarians, of whom 604 returned questionnaires, indicated that 37 per cent of the companies replying prepared abstracts regularly and probably would benefit from a coordination

and integration of efforts. This information, of course, still leaves the matter wide open for discussion.<sup>58</sup>

However, the approach to a solution on a national level, as recommended by the Library of Congress in 1947 and the UNESCO conference of 1948, needs further exploration.<sup>59</sup> National control of scientific and technical information through regional information centers has had much discussion and an outline of future development was presented at a special meeting of the Council on Documentation Research in February 1958.<sup>60</sup>

These lines of future development, insofar as they are of interest in a consideration of the problems of indexing and abstracting services, took the following form. Within two years there would be one or two partially automatic information service centers, and pilot operations would be performing indexing services in various subject fields. Ten years would see several such service centers which would receive processed information ready for use from cooperating societies. The centers would handle abstracting, translating, and encoding in fields where sufficient outside cooperation could not be obtained. In 50 years there would be a network of these regional information centers throughout the country; the processing and service centers would be held together by teletype, television, facsimile, and other media of communication. The services of these centers would be available to participating organizations.

It is estimated that about 10 per cent of the 12.5 billion dollars spent in the United States for research and development, public and private, is spent duplicating projects which have already been completed, largely because the literature has not been searched properly. Such expenditures on duplicated efforts would seem to warrant establishment of coordinated and machine oriented services.<sup>61</sup>

In addition to the tremendous influx in serial publishing in general and the matter of time lag in the appearance of service publications, there are particular problems with which abstracting and indexing services are faced. Among these are "fringe" journals which skirt the periphery of many subject areas and in any comprehensive service coverage must be taken into account, particularly in the science fields.<sup>62</sup> An additional problem involves journals which squarely cover two major subject areas, for it is here that wasteful duplication in service coverage frequently occurs.

All of the foregoing involves the now regularly used phrase "information storage and retrieval" and the vision of intricate electronic

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equipment to be harnessed to pull the tremendous load which such a phrase connotes. It would seem, however, that solutions for the problems of specialist groups regarding information storage and retrieval through computer oriented programs will probably come first since the problems faced by libraries arise largely from an effort to serve many groups simultaneously.<sup>63</sup>

However, the heightened interest in information storage and retrieval as it applies to libraries should stimulate the finding of solutions to these problems in terms of expanded and coordinated institutional systems set up on national and international planes. The United States has taken a step in this direction in the establishing of the National Federation of Science Abstracting and Indexing Services.<sup>64</sup> Much more remains to be done to obtain a satisfactory solution to this expanding problem of storage and retrieval, both in general and special areas of all fields, solutions which will not smack of provincialism.<sup>65, 66</sup>

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