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AUTOMATED SDI SERVICES

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13. ABSTRACT

    An automated SDI service based on tapes supplied by DDC, Science Abstracts, and Engineering Index is evaluated as a component element of the entire HDL information system. Current studies for improving the efficiency are briefly described. In particular, the establishment of a parameter reference service that should shorten the lead-time for the introduction of advanced components and devices into electronic circuits. For its operation, principles established for the ABC storage and retrieval system will be applied.

ABSTRACT

An automated SDI service based on tapes supplied by DDC, Science Abstracts, and Engineering Index is evaluated as a component element of the entire HDL information system. Current studies for improving the efficiency are briefly described. In particular, the establishment of a parameter reference service that should shorten the lead time for the introduction of advanced components and devices into electronic circuits. For its operation, principles established for the ABC storage and retrieval system will be applied.

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1. INTRODUCTION

The SDI service based on DDC magnetic tapes and provided for a period of a year was compared in a preliminary report[1] with the results obtained in an experiment with one preliminary IEEE tape compiling Science Abstracts titles. The INSPEC-2 version of the IEEE Science Abstracts tapes was used. This particular format included titles but no abstracts, and offered the most timely bibliographic record covering international journal articles, symposia, and conference papers. The timeliness was considered more important than the abstracts. Also at the request of our Technical Director we began processing tapes that the Engineering Index, Inc. marketed as a by-product of its monthly bibliography.

Beginning with CY 1971, our subscribers in HDL received five different SDI bulletins each month. Two issues contained titles derived from the DDC tapes (semi-monthly), two were extracted from the IEEE tapes (semi-monthly), and one was derived from the tape of the Engineering Index (monthly). A purge process,[2] which we described in preceding reports, transformed the different tapes into one HDL standard format so that one retrieval program could be used to generate the five issues of SDI bulletins, which varied for each of our subscribers. In each instance the profiles of the subscribers, some individuals and some teams, were matched with terminology constituting the titles and subject headings.

The five monthly issues covering three distinct services separately were deemed appropriate for various reasons:

(1) The subscribers prefer to receive brief print-outs; their brevity facilitated return of the carbon copies to the information office with the users' selections and evaluations in a relatively short time.

(2) The responses from the subscribers are treated as requests and prompted acquision, circulation, and inter-library loan action; thus the workload of the library personnel resulting from the requests was more evenly spread in time.

(3) The statistics kept for the individual response permitted an evaluation of the selections, of the three tape services, and of the subscribers. Moreover, it provided some basis for determining the relative cost and efficiency of each of the three tapes services.

The objective of selecting and building a pool of mission-related bibliographic information from the source tapes for future on-line retrieval operations or for the rapid compilation of highly selective bibliographies on specific subjects is approached methodically through the SDI procedure: first, by the elimination (purge) of all subject groups that are not concerned with the mission of the organization; second, by the selection or matching process that uses the subscriber' interest profiles; and third, by the evaluations of the recipients of the service, as reflected in their requests for the acquisition of titles to be retained in the library, or for a circulation and often retention copy of the selected item.

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[1]Altmann, B., Comparison of HDL SDI Services Based on a Preliminary IEEE Tape and on DDC Tapes, TM 70-25, Harry Diamond Laboratories, Washington, D. C., 1970.

[2]Altmann, B., The HDL Automated Information System, TR 1523, Harry Diamond Laboratories, Washington, D. C., 1970, pp. 36-38.

Another year has passed since the preliminary report on the SDI system was issued and a review of the new service and its impact on scientists and engineers of the installation as well as its contributions to the entire HDL information system is now possible.

2. EVALUATION OF SDI SERVICE

To assess the relative value of the three tape services and the SDI system, one must take into consideration the cost of the subscriptions, the computer time necessary to process the tapes and generate the service, and their relative utility. The computer cost involves tape processing in HDL (1) to eliminate the bibliographic information about titles that are not related to HDL missions or areas of interest and (2) to reformat the remaining entries into an organization that will permit the application of the standardized HDL retrieval or selection program, (3) matching the individual interest profiles with the purged and reorganized tapes, and (4) printing the selected information in the form of individually addressed bulletins tailored to the profiles of particular individuals or teams.

The statistical figures in the SDI service do not cover a period of 12 months; rather they were collected in overlapping periods of 6 to 7 1/2 months from:

the Engineering Index tapes for 6 months (6 issues) with 37,547 titles,
the Science Abstracts tapes for 7 months (14 issues) with 60,397 titles,
and the DDC tapes for 7 1/2 months (15 issues) with 23,924 titles.

The information collected is assumed to be representative, and the numerical information on titles, operations, services, and efficiency was projected, making the evaluation for the period of one entire year.

Table A. Subscription Cost versus Titles Used

Suppliers	Subscripton Cost per year	Titles supplied tapes	Titles retained after purge		Selected from purge tape for SDI Bulletins	
					Unique Titles	All Titles
	($)		(number)	(percent)	(percent)	(percent)
DDC	1,000 –	38,280	28,680	74	33	55
Sci. Abs.	3,700 –	103,527	67,076	63	20	26
Eng. Ind.	6,800 –	75,093	47,846	64	12	15

The Engineering Index tapes supplied about two times, and the Science Abstracts tapes nearly two and one half times, the number of titles supplied by the DDC tapes. After the first computer process, 74 percent of the DDC entries were retained; of these, 33 percent of the titles were selected for the SDI bulletins. A number of titles was published in several bulletins, i.e., was supplied to several clients. This duplication increases the utility of the unique titles to a higher "percentage" of 55 selected and printed in the individual

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bulletins that were sent to the 59 subscribers. The comparable fig-
ures for the Science Abstracts were 63, 20, and 23 percent, and for
the Engineering Index, 64, 12, and 15 percent. These figures reflect
the relative compatibility of the data that the three services pro-
vided with the actual information requirements of the installation,
in that 66 percent of the unique DDC titles, 30 percent of the unique
Science Abstracts titles, and 23 percent of the unique Engineering
Index titles had to be duplicated in the various SDI bulletins
distributed.

The true value of a service can be measured only in terms of the
utility of the titles to the subscribers as reflected by subscriber
response. With each bulletin a carbon copy was distributed, which
the subscribers were requested to return with their evaluations. A
number of subscribers, however, did not bother to return their car-
bon copies. They screened their bulletins and requested documents and
papers of interest directly from the circulation desk. When inter-
viewed about their attitude and opinions, they expressed the desire
to be retained on the subscription list and definitely considered them-
selves to be beneficiaries of the service. These responses, however,
cannot be used in a statistical survey. The results for those co-
operating are given in Table B.

Table B.   Relevance Ratios Calculated for the Returns of Cooperating Subscribers

Tape Service	Titles Published in SDI Bulletins	Titles Selected	Relevance Ratios
			(Percent)
DDC	9,274	2,504	27
Sci. Abs.	7,107	3,221	45
Eng. Ind.	3,315	1,518	45
	19,696 (Total)	7,243 (Total)	36 (Average)

The relevance ratio for the DDC bulletins appears to be 50 percent
smaller than both the ratios of the Science Abstracts and Engineering
Index Bulletins. Concerning this large discrepancy the question was
raised whether the organization by subject groups in the DDC tapes was
less appropriate for processing by the HDL computer program or whether
the selection performed by the subscribers was not sufficiently exhaus-
tive. To resolve the latter question the professional staff of STINFO
screened all the corresponding DDC Bulletins (Government Reports
Announcements and Technical Announcement Bulletins) for pertinent
titles that had not been identified in feedback from the SDI sub-
scribers.

In addition to the 1214 unique titles, a number corresponding to
the 2504 overlapping ones which the 67 percent cooperating subscribers
have selected, this manual screening and selection process added an-
other 1265 titles, thus more than doubling the number of relevant titles.
It can, therefore, be assumed that the relevance ratio of bulletins
derived from the DDC tapes could increase to a minimum of 44 percent,
provided a comprehensive HDL profile will be applied and the print-
out of the corresponding titles will reach the engineers and
scientists who are responsible for their contents.

Time limitations and a missing link between titles on tapes and those in the published (Science Abstracts) bulletins precluded a manual supplementation of pertinent titles for the two other services. It could, therefore, not be established whether the relevance ratios of the other two services can be similarly improved.

The computer costs for the SDI service are listed in Table C. These have been extrapolated to yearly costs in Table D.

Table C. Computer Costs (per 1000 Titles) of the HDL SDI Service Derived From Three Different Tapes

Tape Services	Purge Process		Selection Process		Printing of Bulletins	
	(min)	($)	(min)	($)	(min)	($)
DDC	43.2	112	24.4	64	18.9	49
Eng. Ind.	13.7	36	15.9	41	4.9	13
Sci. Abs.	5.4	14	15.9	41	5.2	14

Without any doubt the format of the Science Abstracts tapes is most appropriate for the present HDL computer hardware as well as computer programs. The programs used for processing the DDC tapes are currently being revised to reduce the relatively high cost.

Table D. Yearly Computer Cost of the HDL SDI Service

Suppliers of Tapes	Purge Process		Selection Process		Printing of Bulletins		Total Cost
	(min)	($)	(min)	($)	(min)	($)	($)
DDC (24 issues)	1655	4303	700	1820	116	303	6426
Engr. Ind. (12 issues)	1034	2688	765	1989	38	99	4776
Sci. Abs. (24 issues)	560	1457	1072	2786	94	245	4488

If we relate the total (subscription and computer) cost to the number of titles that the subscribers selected, the prices are $2.96 for each DDC title, $2.54 for each Science Abstracts title, and $7.62 for each Engineering Index title. For 59 subscribers* the service distributes 295 individual bulletins each month or 3540 bulletins per year. The average cost per bulletin on this basis approximates $7.68. If we take into consideration that the bulletins are also screened by teams to reach a total of 135 staff members, the cost per individual subscriber will be reduced to $3.35. For this price, reference librarians could not render a similar service, even if one acknowledges that selections from some given tapes will not be successful, and some individual bulletins may not be distributed. Neverless, the computer cost of the current services must be reduced; it is hoped that more appropriate programs will improve the efficiency, in particular for the service derived from the DDC tapes.

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*At present the number has risen to 63.

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Whenever warranted by deficiencies in current bulletins, an effort must be made in certain cases to assure a more exhaustive recall of pertinent titles than the matching process with the few specific terms provided by a profile formulation will permit. We have selected from the tape of the Engineering Index Thesaurus the HDL mission-related terminology and are therefore prepared to introduce broader, narrower, or related terms into the profiles without manual effort.

An important objective, still, is a more exhaustive exploitation of the tape services we receive to collect a comprehensive data file to support future bibliographic requirements. For this purpose the HDL information office is preparing interest profiles going beyond the scope of those provided by our subscribers. These profiles are based on the information furnished by DD 1498 (Research and Technology Work Unit Summary), DD 1634 (Research and Development Planning Summary), and DA 3664-R (Research and Development Planning Summary Army R&D Management Data), which relate in greater detail the scope of the current HDL and HDL-related scientific and technical efforts.

While the combination of ephemeral user requirements with a mission-concerned HDL-wide profile should enhance the recall capability of the system and the strength of the HDL service as a reference center, efforts must also be exerted to improve the relevance ratios of the SDI bulletins and of the future bibliographies to be derived from the installation's growing data file. The test results indicate the necessity of such an improvement.

The cooperating segment of our subscribers whose feedback provided the statistical data for this study represent 67 percent of all sub-scribers, each of them receiving an average of 500 titles during one year. The minority of 33 percent that was not inclined to communicate their own selections and evaluations to the personnel operating the service received an average of 1100 titles. This result makes it imperative to pay attention to a possible relationship between bulletin size and subscriber cooperation.

On the basis of the statistical information derived from the returns made by the so-called cooperative group, it appears that the average bulletin processed by members of this group comprised eight titles. The comparable size of those received by the group that did not return their bulletins regularly was 18. Although the difference in numbers of titles is not so great to deter fully occupied engineers and scientist from cooperating with the library, we will attempt to refine the profiles more frequently, and furthermore, explore whether smaller-size bulletins will not only result in better cooperation, but will also induce a greater number of the professional staff to subscribe to the service.

Any type of compulsion is contrary to HDL policy. All subscriptions and all communications are voluntary and primarily motivated by the personal advantage of the subscriber.

To refine the selectivity, in addition to the present regular review and adjustment of the subscribers' profiles, the programs are being changed to introduce weight factors which the indexers of the three tape-producing reference centers provided in different ways: DDC by adding asterisks to terms considered representative of the main contents of the paper or document, and Science Abstracts and Engineering Index, by assign-ing a broader heading under which the descriptive terms and phrases or the analysts are placed in the index. Furthermore, the number representing the subject group of the printed bulletin to which the analyst assigns a title will be used in our effort to limit the output in response to a particular profile.

3. INTEGRATED INFORMATION PROGRAM

Within the overall system of our information office the SDI program has exceeded its original purpose, i.e., the selective dissemination of current pertinent literature. It contributes significantly to our selection and acquisition activities and serves as a vehicle for accumulating the mission-related information that must be made available to fuide future operations of the installation intelligently and efficiently, in fulfilling its responsibilities as a lead laboratory and reference center. It has been recognized that the SDI service could also be used to automate the cataloguing activity. The realization of this possibility has been made the subject of a continuing study.

Recently another project has received a still higher priority. This project has the objective of informing the design engineer about current objectives in materials and components research and development so that he can consider, in current designs of electronic circuits, the most advanced methods and products that can be utilized in the production phase. To do this, the potential of components currently under study and development, and their anticipated characteristics and parameters must be known. Present plans are to develop access to relevant parameters information as part of the HDL SDI operations. Such access is presently not provided by information centers, because they limit their indexing effort to the subject content of the reports and papers and completely omit numerical data. This limitation also curtails the usefulness of the GIDEP (Government Industry Data Exchange Program) which is concerned with on-shelf or completed items. Although the HDL project will not cover GIDEP reports, it must be related to the future indexing efforts of this much more comprehensive service, and attempts will be made to coordinate studies and solutions with those that GIDEP might offer at a later time to cope with the parameter problem.

In order to establish a parameter information center for airborne-electronic engineering applications, the HDL Information Office must extract and analyze the pertinent publications (reports, articles, etc.), because the information centers have not only excluded numerical data from indexing, but also do not record all useful or necessary data in the abstracts on their tapes. In many instance, the office will have to request the appropriate information directly from the sources on specially designed questionnaires as soon as relevant projects have been announced through DD Form 1498, DD Form 1634, and DA Form 3664-R, and the Status Reports on Advanced Electron Device Technology, issued for the Office of the Director of Defense Research and Engineering, or through the specialized tape service to be acquired from the Smithsonian Science Information Exchange.

For the retrieval of pertinent data from the abstracts on the tapes, a conceptual approach is recommended that can be described as a reverse form of our ABC method.[3] This method was conceived to eliminate the tremendous, if not impossible, task of producing and maintaining a complete thesaurus of millions of terms and phrases annotated to identify semantic and grammatical peculiarities and syntactical requirements, the preconditions not only for retrieval operations but also for automated string analysis, textual standardization, and computer translations. The HDL method generates as a by-product a compilation of the entire processed and continuously accumulating terminology in groups identified by functions or relations. It is an extension of Jost Trier's[4] concept

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[3]Altmann, B., The HDL Automated Information System, TR-1523, Harry Diamond Laboratories, Washington, D.C., 1970, pp. 36-38.

[4]Altmann, B., and Walter Riessler, Automation of ABC System, TR 1392, Part I, Linquistic Problems and Outline of a Prototype Test, Harry Diamond Laboratories, Washington, D. C. 1968, p. 17.

that any person attempting to communicate a hunch or idea must throw a
net (i.e. a loose structure of thoughts) over an initially hazy intui-
tion to catch its contents or meaning before representing it in the
customary and precise symbols of a given language. A test proved that
the utilization of this method for processing or indexing will also
create various word-independent storage and retrieval systems.

In our task of extracting parameter data from tapes we cannot work
with a standardized indexing terminology, but must deal with a great
variety of linguistic forms in which parameters can be communicated and
are in fact recorded on the different tapes. It is, therefore, planned
to construct typical combinations, nets in Trier's terminology, to
catch the parameter data and transform them into a standard format. We
have started to collect the linguistic forms and expressions for para-
meters from different abstracts and texts. At this time the terms for
measuring units such as "ohms," "volts," "farads," etc. appear to be
the most efficient symbols that can be applied to trigger a comprehen-
sive automatic printout of the desirable parameter data. Because these
names for measured units will frequently be introduced by prefixes such
as "mega," "kilo," "milli," "giga," etc., to define particular magnitudes
a truncation to the left and to the right appears to be a logical answer.
Although the method is feasible according to a preliminary analysis and
estimate, it is admitted that the efficiency of this idea must still be
proven in test. In addition, various prepositional and verbal combina-
tions are being considered to formulate succinct and effective retrieval
profiles.

Although the automatic process of retrieving pertinent data from
tapes should provide access to a great number of indexed reports and
papers, it is anticipated that the texts themselves, reports and
papers in addition to the answers to our questionnaires, will have to
be consulted and analyzed for adequate selection and evaluation in
many instances.

One product of the service will be a card catalog, arranged alpha-
betically by components, devices, and materials, each of them sub-
divided by the names of the parameters and their numerical ranges in
ascending order. The location symbol of the source document will
guide the engineer to the more detailed information. An SOP on the
arrangement and the presentation of the numerical information has
been previously prepared and tested in connection with our ABC pro-
ject.

A second product of the project will be a KWIC list of the descrip-
tions (i.e., parameters) of all the items in the information system.
The required specific parameter data for a particular component or de-
vice can therefore be found easily and evaluated in context with all
its other parameter data.

While the inclusion of the parameter information service will broaden
and intensify the activities of the HDL reference service in so far as a
renewed re-evaluation of existing indexing and retrieval methods will be-
come necessary, the present SDI service will also be subjected to a
critical review towards aiding this effort. More appropriate computer
programs are being written to improve the efficiency, in particular, for
the service derived from the DDC tapes.

Whatever improvements result from these changes and other experiments,
we cannot expect to achieve services that will greatly exceed those of a
good subject card catalog. We would deceive ourselves if we assumed that
any automated system using combinations of terms or subject headings with
or without statistical manipulation can overcome the inherent limitations

of such a system. Even tests construed to prove the opposite are not con-
vincing because they are based on a defective understanding of the thinking
process and of the nature of language. The root[5] of the trouble is that
present automated systems cannot handle natural language and, when artifi-
cial languages must be used, the systems tend to create as many problems
as they resolve. There is some confusion on this point because existing
systems--"keywords" systems, for instance--can cope with isolated words.
But as any student of a foreign language has discovered, recognition of
isolated words is not at all the same as handling natural language. We
can in this connection only point to the innumerable ways one thought or
concept can be formulated linguistically, and to the many different
meanings one word will assume in different contexts. The functional role
of the preposition, for example, is not determined by logic, but by
etymology, and long established custom or rule. A project governed by a
mechanistic concept that words, the symbols shaped and changed during the
long history of people and nations, can be put together like a jig-saw
puzzle is probably destined to end in failure. The much more complex
project of computer-assisted translations that the Air Force has operated
offers an outstanding example. The selection of books was excellent, but
our scientists and engineers who received the translations frequently
requested new ones because the English texts were distorted and did not
make sense.

4. CONCLUSION

The trend toward mechanistic systems rather than toward conceptual and
therefore more efficient and successful information systems has been dis-
heartening. Therefore, it is gratifying to see at least two projects (see
supplements A and B) in which the basic principle of encoding well defined,
and consequently meaningful, statements or descriptors for retrieval has
been revived. If both projects persist, the results should contribute to
a better understanding of the importance of the linguistic element in
documentation and of its philosophical or psychological peculiarity; I
believe the results could further reflect negatively on the efficiency of
statistical and mathematical methods and techniques. A departure from
mechanistic and atomistic concepts concerning language and the introduc-
tion of a humanistic approach must, in order to succeed, be accompanied
by a management policy that insists upon integration of all efforts into
an overall system. If arguments for economy are allowed to restrict the
scope of an individual project to very narrowly defined, isolated tasks,
these in the end must turn out to be expensive, short-lived, and largely
wasteful. A restricted SDI activity presents a good example. It will
always be a relatively costly enterprise, whatever the number of its
subscribers may be, unless its functions are broader than the production
of bulletins. Logical additional functions are: support of the acquisi-
tion policy of an installation, generation of the data bank from which
mission-related efforts can receive substantial information on the entire
available state of the art, and assistance in required specialized
analytical services not provided by national or professional documenta-
tion centers.

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[5] Bross, Irwin, Roger Priore, and others, Feasibility of Automated
Information System in the Users' Natural Language, American Scientist,
57, No. 2, 1969, p. 195.

HEALTH ELEMENT ASSESSMENT PROJECT

The purpose of the Health Element Assessment Project[6] is the development of standardized syntactical statements describing the contracts or grants of the Health services and Mental Health Administration Department (HEW) and their objectives, in such a way that all elements of the statement can be made subject to a computerized retrieval operation.   For guidance of the analysts who generate the input, a work sheet in matrix format has been designed to assume a standard sequence of contractor or grantee, the verb expressing his activity, the noun representing the substance or direct objective of the contract, the indirect objectives (several possibilities), the geographic limitations of the effort, and finally the procedure (method or technique).   Each of the noun entries mentioned can be preceded by an adjective (or qualifier); and each noun in the string following the verb can be introduced by a link to establish the accurate relationship between the subsequent nouns.   Furthermore, each noun entry can be a compound of up to four terms (nouns or adjectives). Great importance is attached to the verb because each verb used in a description requires its own string, and work sheet even if all other entries are identical.   Some preparations have been made to restrict the choice of the verbs.

The ABC system differs from this project in various respects.   It always nominalizes the verb, thereby frequently combining it with the basic method or technique of the effort; it distinguishes between noun and qualifiers and avoids the confusion when adjectives and nouns are used as qualifiers and as elements of a compound phrase; it does not encode prepositions or prepositional phrases because the use of prepositions is not governed by logic but by etymology and grammatical rule. It identifies, however, functions and relationships, and makes it clear whether they refer to the preceding element (or entry) or to the main subject of the string.

It will have to be demonstrated by test whether the project in its present form will facilitate satisfactory retrieval of specific aspects included in the descriptive strings of the Health Elements and whether the system can be expanded to control and standardize the accumulating data.

Seemingly the author of the project does not consider the automatic construction of syntactical thesauri and of more sophisticated retrieval methods because they are not required in this particular service.

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[6]Lowell, D. James, Health Element Assessment Manual (Preliminary), Office of the Administrator, Health Service and Mental Health Administration, Department of Health, Education, and Welfare, Rockville, Maryland, 1971.

PRECIS SYSTEM

The PRECIS[7] as well as the ABC methods, attempt to construct syntactical descriptors with the assistance of a computer. D. Austin at first relied to a great extent on the sequence of the individual key words within the string for tne identification of their relationships to the main subject term as well as to each other, but he soon recognized that this approach as well as distinctions between generic, attributive, possessive, and cause-effect relationships did not eliminate ambiguities. He, therefore, developed a system of "interconcept links," and for this purpose introduced 16 symbols called "relational operators" that were to designate functions such as form and audience of publication, viewpoint, discipline, environment, etc. These operators are relatively broad and are not always clearly delineated. It might, e.g., be difficult to distinguish between "study region" and "environment" as demonstrated by his classification of "Great Britain" as environment rather than "study area." Furthermore the introduction of "Concept Codes" and "Term Codes" have increased the difficulty of the analysis. The list of "Precis Entries" attached to the report seems to point to the fact that greater emphasis is placed on the standardization of lead concepts or keywords under utilization of UDC codes rather than on the standardization of functions and relations. For the clarification term relationships, the author found it necessary to introduce "interconcept links" in natural language in addition to his relational operators (codes).

The ABC system is not concerned with interlinkage phraseology during the analytical process, but has provided standardized prepositions and other connectors that are added by the computer during program execution. The analyst can concentrate on the subject matter when he answers the standard input (form) questionnaire; and program and computer assure standard sequence and combinations of terms and phrases within the string, generate separate thesauri by encoded functions and relations, and, with the data file thus formatted in the memory, facilitate standardization of future inputs and operation of different types of retrieval systems including an automated question-answering service.

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[7]Austin, Derek and Peter Butcher, PRECIS, A Rotated Subject Index System (and Supplement), London, Council of the British National Bibliography 1969, 87 (17).