# ANALYTICAL STUDY OF SEMANTIC AND SYNTACTIC APPROACHES TO SUBJECT HEADINGS: REVIEW OF ISSUES, PROBLEMS AND SOLUTIONS

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as partial fulfillment of the requirements for the
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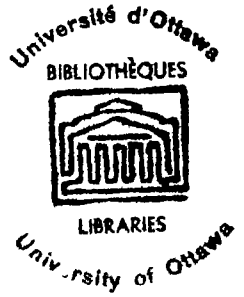


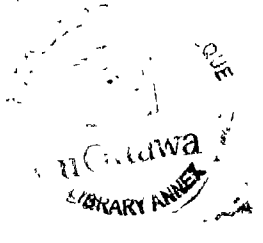

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## CURRICULUM STUDIORUM

Mohammed Talib Hussain was born January 28, 1928, in Hyderabad, Andhra Pradesh, India. He received the Bachelor of Arts degree in Economics in 1948 and Bachelor of Laws degree in 1953 from Osmania University, Hyderabad; the Post-graduate Diploma in Library Science in 1957 from Nagpur University, Nagpur; and a certificate in "Library and the National Development" in 1959 from the Delhi University, Delhi.

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# INTRODUCTION

Subject headings are terms denoting subjects under which material is entered in a catalogue[1]. So long as the subject of the indexed document can be expressed in a single word, it does not pose any special problem. The multi-faceted books and micro-documents of today often require multi-worded terms, called multiple headings, to express their specific subjects and headings of this nature give rise to complications and need standardization.

Assigning subject headings is not the same as classifying the subject matter of a document. In the process of classification, attempt is made to fit the classified subject in the universe of subjects and in subject heading work it is intended to formulate a precise representation of document, of course best possible to fit as a point of reference. Both aim at providing the facility of relevance judgment. Thus, a subject heading is indicative of the subject as far as the topic requires and language permits.

In subject heading work, specific subjects of documents are rendered in words of a natural language which are also a medium of search by users. It is at this level that multi-dimensions of subjects on one hand and linguistic

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1 Library of Congress, Departmental and Divisional Manuals, No.3: Subject Cataloguing Division, Washington, 1950.

limitations on the other make the process of two-way communication between the system and user variable. However, the merit of direct retrieval has won popularity for alphabetical arrangement so much so in U.S.A. that J.Lee Harris[2] was led to think that alphabetico-specific subject headings are essentially a phenomenon of the U.S. This might be partly due to the influence which C.A.Cutter had for a long span of time in the field of subject heading work.

1) Subject heading work an art. - Failure to discover principles for framing precise, adequate and comprehensible subject headings is condoned by declaring that subject heading work is an art and subject cataloguers are born. Of course, it is a fascinating intellectual performance and an adventure in the discovery of the exact subject with all its dimensions and in rendering it in words of a natural language. With all usage restrictions and linguistic limitations, it has to be direct and as specific as the subject of the document indexed. The thoughtless application of subject headings from a standard subject heading list is a dry routine, whereas it could have been, as P.C.Coetzee[3] put it, "an education in discovery, analysis and synthesis".

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2 J.Lee Harris, Subject Analysis: Computer Implications of Rigorous Definition, Metuchen, J.J., Scarecrow, 1970, p. 15.

3 P.C. Coetzee, "Syntactics and semantics of the subject headings", in Mousaion, No. 21, p. 1-41; No. 22, p. 1-30; No. 23, p. 1-30, 1957.

Being an expression functioning as a medium of communication, as well as a point of reference, it involves imagination, judgment and informed feeling for the choice and structure of subject headings: imagination and analytic mind, for visualising the user's approach; judgment, for determing the specificity of subject headings; and informed feeling, for discovering significant traces for citation based on experience at the use of subject catalogue. No standardization can replace judgment and sense of values. Standardization proposed by Kaiser in the shape of 'Concrete-Process' formula yields subject headings like 'Nations-Interrelations' for a commonly known simple subject 'International relations'. To illustrate further, determination of entry element in 'Swimming accidents' - either to be Swimming or Accidents - depends upon the sense of values.

2) Subject heading work, a guessing game. - The subject cataloguer's choice and structure of subject headings rests on his guess - may be an educated guess-of user's subject approach to books, vis-a-viz,the user's choice of search terms is based on his guess - may be a layman's guess-of a subject heading under which the subject cataloguer might have entered the required material. Why it is so? The substantial evidence of users' experience at subject catalogue, a source of feedback, has been sparse and, on the other hand, systematization of subject heading work has not been persued emphatically. The Library of Congress subject headings, are a

monumental guess work and are no more than an accretion of arbitrary decisions. As remarked by R.K.Olding:[4] "Whilst being valuable as an example, Congress may not be satisfactory as an authority." Besides, in these days of 'knowledge explosion', a subject cataloguer cannot be expected to master all subject fields. In determining the specificity of the terms to be chosen and displaying the subject relations, his decision is often based on guess or groping in the dark.

3) Subject Heading work, both an art and a scientific technique. - It is an art because of the aptitude required of a subject cataloguer and it is a scientific technique, because, semantics and syntactics of subject headings are logical processes which can be mastered by persons of average intelligence. For example, Ranganathan's suggestion to arrange facet terms in a subject heading according to 'Wall-Picture' principle, explained in detail later in this study, is as simple as any other formulation. To a large extent, these processes can be rationalised and even mechanized. The IBM's Auto-Indexing, C.N.Mooers' Zatocoding, Samain's Mechanical Selection method are the examples of such rationalization and mechanisation. Multiple subject headings still provide a rich field for research by a team comprising librarians, linguists and psychologists.

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4 R.K.Olding, "Form of Alphabetico-Specific Subject Headings and a Brief Code" in Australian Library Journal, Vol. 10, issue of July 1961, p. 232.

4) Significance of this study. - In spite of the learned efforts to frame the guiding principles of subject indexing, a vast majority of libraries, even special libraries, prefer to follow one or the other of the standard enumerative lists of subject headings. This is indicative of two situations:

a. In general, subject cataloguers do not have a firm grasp over the semantics and syntactics of subject headings, and

b. The exponents of systematic alphabetical subject indexing field could not so far prove their case before the profession.

Of such efforts, a few are outstanding but are isolated approaches. J.C.Schwartz' 'Noun Rule', J.Kaiser's 'Concrete-Process' formula, Farradane's 'Relational Analysis', etc., are examples of such partial approaches. Even the comprehensive contributions made by C.A.Cutter, Library of Congress, J.W.Metcalfe,[5] S.R.Ranganathan and Mortimer Taube are not compatible with the ever-growing and diversified needs of information storage and retrieval of the present day. The knowledge explosion resulting in literature explosion, enormous increase in the number of users of information systems and radical changes in research phenomena

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5 J.W.Metcalfe, "Tentative Code", in his Classifying and Indexing of Libraries and Literature, New York, Scarecrow, 1959, p. 263-292.

are a few of the challenges; hence the need for a unified approach to subject control of information with re-statement of objectives and renovation of methodology. Amongst the developing trends of complete automation of documentation, it is quite timely to establish the adoptability and simplicity of systematized alphabetico-specific subject heading work, attempted in this study as opposed to the expediency approach. Time is ripe for revolution in subject heading practice through cooperation between librarians and subject specialists on the forum of professional bodies to bring about agreement on principles to guide choice and form of subject headings.

5) Method of treatment. - It is not the intention to present a mere criticism of the theoretical edifice of subject heading work which has evolved through the decades and to devise a subject indexing system which may be good "for all points and purposes." The majority of solutions so far proposed are meant for manual systems. Mechanically or electronically operated systems obviously require a different methodology. It is necessary to be selective in our approach. This study is restricted to manual systems. Based on alphabetical subject approach to information, the issues involved in subject heading work have been identified briefly. Except where elaboration of a point of view is necessary, descriptions and examples have been dropped. Reviewing the problems posed by the writers of subject heading field, solutions have been suggested by recommending S.R.Ranganathan's "Facet Analysis and Sequence"

as an optimal base for subject heading work which takes cognizance of semantic and syntactic issues with emphasis on user-relevance. This is our hypothesis in this study. Thus it will be seen that in spite of there being a vast literature relating to subject cataloguing, no exposition of this type has appeared. This study may serve as a supplement, if not as a substitute.

# CHAPTER I

## PSYCHOLOGY OF THE USE OF SUBJECT CATALOGUE

### 1. - NEED FOR EXAMINING THE PSYCHOLOGICAL ISSUES.

Approach to subject catalogue is basically an act of mind whether it be from cataloguer's point of view or from user's view-point which respectively constitute the input and output of an information retrieval system as shown in Figure 1 on the next page.[1] The Action Line No.1 represents selection of information units and addressing them into the proper segments of the file called information storage. The Action Line No.2 represents locating of needed information in the file and is called search operation. The result is either information retrieval or failure, is, the output of the system.

The significance of psychological factors in the role of subject headings will be apparent, if operation of an information retrieval system is examined as in the Model shown in Figure 2 on the next page. It shows that subject catalogue is in constant interaction with literature and user which are composed of their own sub-systems that are of abstract/concrete nature. Perfect formulation of search strategy is achieved by eliminating the difference between the actual information need and its verbalization which in turn has to be in agreement with subject representation (subject headings) in the system, if search operation is to end in a success. Thus it will be

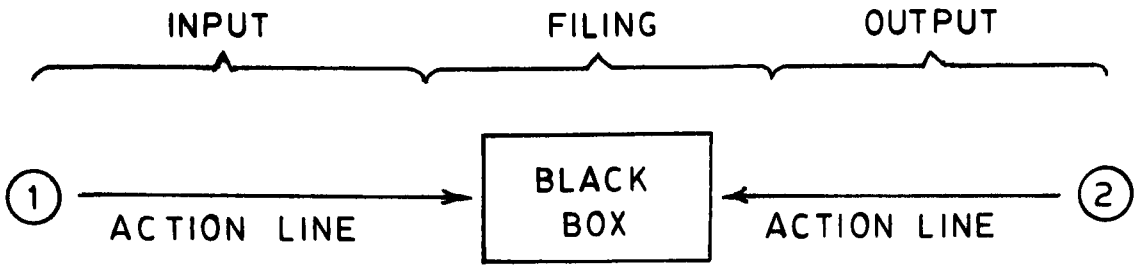


FIG.1: MODEL OF AN INFORMATION RETRIEVAL SYSTEM COMPRISING THE BASIC SUB-SYSTEMS

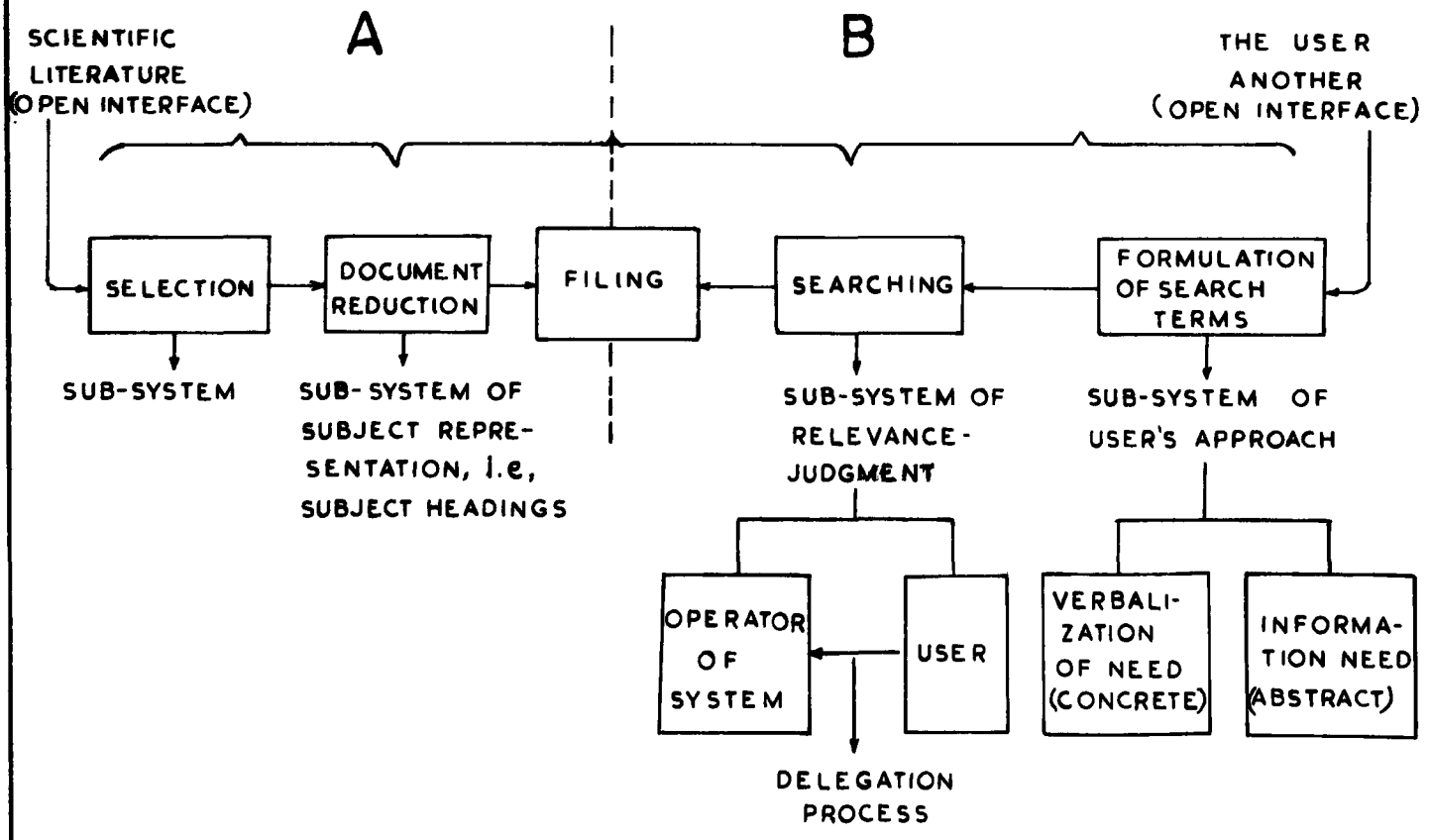


FIG. 2: MODEL OF OPERATION OF AN INFORMATION RETRIEVAL SYSTEM

seen that retrieval of information is an equilibrium of the three. If search is conducted by the operator of the system on behalf of the user, as it happens in many a research organization, the delegation process involves further subtle issues and user's satisfaction rests partly on the efficiency of delegation mechanism also. It can also be noted that the two larger sub-systems A and B (indicated in Figure 2 by a dotted line) are in constant interaction through the information file (subject catalogue) and feedback one another. Thus, user is the chief beneficiary; hence, a subject indexing system is to be evaluated by users' satisfaction, not by its conformity to a set of abstract principles, and by ease and efficiency in consulting, not by ease and economy in compiling.

## 2. - USE - STUDIES

It is usually complained that there is dearth of systematic studies of the use of subject catalogue. D.J.Haykin[1] is one of them. But in the recent past, many useful studies have been undertaken and reported.

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1 D. J. Haykin, Subject Headings: a Practical Guide, Washington, G.P.O., 1951, p. 4.

As suggested by G.Scheerer,[2] there can be two types of use-studies: statistical, for quantitative data on supply and demand, that is, users' experience at subject catalogue; historical,for qualitative differences within a subject field. The use-studies reported from the U.S.A. and the U.K. are of these types: Saul Herner's[3] study at John Hopkins University, U.S.A.; Studies in U.K. : J.D.Bernal's,[4] D.J.Urquhart's,[5] and ASLIB Cranfield Research Project.[6] C.J.Frarey[7] has reported the results of twenty-seven such studies made from 1930 to 1952.

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2 G. Scheerer, "A Subject Catalogue Examined", in Library Quarterly, Vol.27, issue of July 1957, p. 187.

3 Saul Herner, "Information Gathering Habits of Workers in Pure and Applied Sciences," in Industrial and Engineering Chemistry, Vol. 46, issue of January 1964, p. 228-236.

4 J. D. Bernal, "Preliminary Analysis of Pilot Questionnaire on the Use of Scientific Literature", in Royal Society Science Information Conference, June 1948: Report and Papers Submitted, p. 589-637.

5 D. J. Urquhart, "Distribution and Use of Scientific and Technical Information", in Op.Cit., p. 408-419.

6 C. W. Cleverdon, "ASLIB Cranfield Research Project on the Comparative Efficiency of Indexing Systems", in ASLIB Proceedings, Vol. 12, issue of December 1960, p. 421-431, also reported in his article "An Investigation into the Comparative Efficiency of information retrieval systems", in Unesco Bulletin for Libraries, Vol. 12, issue of Nov. - Dec. 1958, p. 267-270.

7 C. J. Frarey, "Subject Headings, New Brunswick, N.J., Rutgers University Press, 1960, p. 22 and 23.

## 3. - USER'S APPROACH

As shown in Section 1 above, user's approach is deep-routed and has with it a constellation of factors. The following factors are pertinent to the hypothesis of this study:

i) Predictability of the approach. - In many cases, predictability of subject approach expected of user is only an educated guess. However, the following generalizations can be made with some certainty:

a. On account of the usage principle, the search terms to be formulated by user can be predicted.

b. Relevance of subject field to predictability:

In Science and Technology, depth of subject analysis expected of a subject heading is predictable. User in this field prefers to search under most specific and minute terms. This might be an effect of narrow specialization in this field. Besides, technical terms are preferred over popular terms. The common use of the jargon of specific fields accounts for this trend.

In Humanities, there is no evidence of user's approach being comparatively broader in depth of analysis and choice of terms. What has been often told about popular subject approach in public libraries is due more to the type of library rather than the type of subject field.

c. Relevance of type of library to predictability:

> In special libraries, user, normally well-informed, adopts a specialist approach and in public libraries, user who is normally a layman prefers to search under the terms broader than the exact subject of his interest. A casual reader in public libraries has neither time nor desire to know the method by which subject-access is provided.

ii) Factors determining the approach. - Basis of user's approach is psychological rather than logical, resting on personal factors like educational level, age, social class, geographical affinity and occupation. Compared with a layman, an educated person would search under more specific and technical terms. This is true of larger groups distinguished for levels of literacy, say laymen and specialists. But, as reported by Saul Herner[8], the extent of formal education within a group did not influence the information gathering habits. He also testified that there was little effect of age on the manner and the extent to which people obtained and used information. However, the approach of users in higher age bracket will be mature as compared to that of the youth and the children. Saul Herner's finding showed that the field of work and the type of organization in which the users work are the definite factors affecting their approach.

Some authors have expressed their doubt about the summability of psychological factors and consider them as, to use G. Scheerer's phrase, "psychologically incalculable".

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8 Op. Cit.

They advise that decision in this respect should be made upon an objective basis, not on mind reading basis.

iii) The Tested Evidence. - As summarised by C. J. Frarey in his findings on the survey reported in Chapter I, Section 2 above, subject catalogue is used about equally with the author and the title catalogue but in its present form it is not an indispensible instrument. It is chiefly used for specific reference, i.e., as a directory to shelf location, and for generic survey, i.e., to select suitable books on the subject of one's interest. It is rarely used to develop a bibliography of a subject. Virtually all use of subject catalogue is non-specialist use and the material sought is normally in English language and of recent origin. Organisation and content of subject catalogue are difficult to be used, because the rule of specific entry is not understood and consistant. Methods of subject entry do not conform to typical user's approach. Subject headings are confused by users with title entries. Filing arrangement and cross reference structure are not clearly understood.

iv) The New Challenge. - Proliferation of scientific literature on one side and the change in requirements and techniques of modern research on the other side have developed a new attitude in the beneficiaries of subject control of information, namely, automation of scholarship and learning, as J.W. Metcalfe

as J. W. Metcalfe[9] put it, or completely automatic documentation, as de Grolier[10] named it.

To sum up, the psychological factors of user's approach, either already testified by the use - studies so far made or now making their appearance felt as new trends, are pertinent to the study of the functions a subject index is to perform.

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9 J. W. Metcalfe, Information Indexing and Subject Cataloging, New York, Scarecrow, 1957.

10 Eric de Grolier, A study of Gèneral Categories Applicable to Classification and Coding in Documentation, Paris, Unesco, 1962.

# CHAPTER II

## FUNCTIONS OF A SUBJECT INDEX

Merits of a subject indexing system are relative to the purposes it has to serve. It is for this reason that choice and structure of subject headings need to be considered in the perspective of the functions the subject index is to fulfil. For example, in a special library, the subject catalogue functions to cater the specialist needs of the clientele with deep subject analysis expressed in the jargon of the pertinent subject fields; whereas in a public Library the subjects of the documents are analysed from a generalised view point and rendered in popular terms.

### 1. - FACTORS DETERMINING THE FUNCTIONS

Size and nature of collection or literature to be indexed and nature of clientele are talked about as determinents of the functions of a subject catalogue. But this common belief requires a little modification. The major functions of a subject catalogue - to serve as a medium of communication and a totality of points of reference providing specific reference and generic survey - remain unaffected by the variables just mentioned. The actual variation takes place in the depth of functions, not in the over-all functions themselves. Let us take size of collection as a variable. Whether a collection is small or large, the subject entries have to provide the facility of specific

reference. However, the choice and structure of subject headings will vary. For a small collection, mostly single-word subject headings will be sufficient; whereas, for a large collection, subject entries need to be individualised by using subdivisions and sub-subdivisions.

Relation of subject index to other parts of catalogue also determines the functions the subject entries are to perform. If it is a classified catalogue, subject index is used as a directory of shelf-location via classification. The subject entry comprises a subject heading followed by a directional phrase (for example, 'For books on this subject, see ...') providing a reference to class number. In case it is a dictionary catalogue, subject entries provide direct access to pertinent documents. The entry comprises a subject heading followed by a description of the pertinent document, also providing a reference to the place of the document on the shelves.

## 2. - THE FUNCTIONS

As an ideal, the concept of 'Universal Indexing' has attracted the attention of the theorists of subject heading field and it was this trend that led them to the discussion of 'indication' and 'communication', or to be more specific, of 'conventional subject analysis', 'biblographical analysis' and 'information analysis' which have been dealt with in necessary detail later in this study.

J. W. Metcalfe defined Universal Indexing as: "[...]Indexing every thing in a piece of literature, intentional, incidental and accidental that could possibly be of interest to any one, any where any time!"[1] He further compares it with the American Telegraph Service being "for all points and purposes".[2] Let this not be confused with the Universal Bibliography started by Otlet around the turn of the 19th century; ofcourse, it also aimed at intensive and extensive indexing. The Universal Indexing is too ambitious to be achieved. Metcalf said:

> In theory there may be a method of analysing and indexing documents for all points and purposes, but in practice it may be, in all its incarnations, what a chimera was supposed to be, lion's head, goat's body and serpent's tail, neither fish, fowl, nor good red herring, fooling all the people some of the time, some all the time, but we hope not all all the time.[2]

Lesser in scope, the concept of 'Multiple function' also has been advocated for a subject index. It should be so designed that at a time it may serve as catalogue, index and Bibliography so that it could attract more users. It may be good to be aimed at but it would be cumbersome as a finding aid and prohibitive in cost. Instead, selectiveness in functions increases the efficiency.

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1 J. W. Metcalfe, Subject Classifying and Indexing of Libraries and Literature, New York, Scarecrow, 1959, p. 12.

2 J. W. Metcalf, Information Indexing and Subject Cataloguing, New York, Scarecrow, 1957, p. 20.

The common specific functions of subject indexes and subject headings can be enumerated as follows:

i) To function as a medium of communication. - The literature/collection is chanelled to use through subject headings, as already examined in Model II of an information retrival system given in Chapter I. It is not the full texts of documents that stand in first contact with the user or searcher, but it is their reduction or representation on which the open interface of user interacts and relevance judgements are made. Thus the role of subject headings in its capacity of communication is vital. If subject representation in subject headings is incorrect or even inadequate, pertinent documents may not be retrieved when searched for.

There is another significant phase of this function. Whether a subject heading should be mere indication of subject or should it go deeper to communicate information and shall stop only short of an abstract. In case of subject indication, relevance judgment made by the user is an educated guess, if not arbitrary. The more deeply the subject is analysed, the more fully the subject heading would represent the pertinent document. A busy researcher depending on others for his personal services like repair of his car, T.V., etc., is justified in looking forward to an information retrieval system for providing the best possible facility for relevance judgement, if not the actual information - content required by him. This has been termed

by Metcalfe[3] as indexing of information by subjects, not indexing of subjects alone. If we go further back, we find C.A.Cutter advising to index by subjects not by classes of subjects.

Subject headings do not enjoy complete freedom as other media of communication do. There are limitations on vocabulary. Preferably such terms are to be used in subject headings that an individual uses habitually and confidently and then such expressions are to be used, of which a user is able to recognise meanings more or less precisely but which he will not readily use in communication. These are respectively called active and passive vocubalary.[4]

As compared to oral communications, subject headings are not easier to get across -- to convey what we intend to. In oral communication, the sender of message can assist the receiver in grasping the sender's intention, but subject headings are short of this facility. They have no feedback, i.e., knowing the reaction of the receiver.

Compared to other written communications, subject headings do not have the convenience of employing a number of safeguards against misapprehension, such as definition of terms,

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3 Op. Cit.

4 P. C. Coetzee, "Syntactics and Semantics of the Subject Headings, in Mousaion, No. 21, p. 1-41; No. 22, p. 1-30; No. 23, p. 1-30, 1957.

use of descriptions, repitition of proposition in different words, etc. Cross-references are the only device at the disposal of subject cataloguer against all the types of short-comings mentioned above.

ii) To function as a point of reference. - A subject heading is not a mere label of a stored item (information) but has to be as attractive and potential to a searcher as a copy-righted trade-name which catches the eye of a buyer and is also highly indicative of the speciality of the marketed item.

In the capacity of a point of reference, subject heading is a servomechanisms, ie., a machine that directs, functioning with cross-references as switching devices. Its mode of operation is centrifugal as against the centripetal classed catalogue. But by display of subject relations through cross-references, an alphabetico-specific subject catalogue binds the referents together otherwise spread all over the catalogue on account of alphabetical arrangement.[1]

Being an entry element, a subject heading is liable to be more elliptical than other types of headings. This attribute of subject headings puts it in the process of constant readjustments between linguistic restrictions and demands of deep subject analysis. That is why a subject heading is said to be indicative of the subject as far as the topic requires and language permits.[1]

Potency of terms as points of reference provides a base for word-order in a multiple subject heading. This is a crystalized generalisation resulting from the concept of significance of terms which has been the basis of all subject heading theory.

iii) To provide specific reference. - The primary purpose of subject headings is to facilitate user in locating the needed material easily, promptly and with minimum confusion. In order to achieve the desired qualities in retrieval, subject headings have to be consistent and co-extensive with the scope of the document indexed. In choice of terms, the indexer must be guided by the principles of user-relevance and verbal freedom, the latter in the sense that our subject heading practice should permit introducing new terms when required. This updating of vocabulary has been termed as "Osmosis".[5] However, choice of vocabulary and display of subject relations need to be controlled. The recent thesauri of specific subject fields have been of much help in this regard. Simplicity of cross-reference structure and consistency in filing practice are also important factors, though external to choice and rendering of subject headings.

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5 S. R. Ranganathan, Classified Catalogue Code, with Additional Rules for Dictionary Catalogue Code, 5th ed., Madras, Madras Library Association, 1965, p. 17.

iv) To provide a generic survey. - As a secondary purpose, subject index has to show what the library has on a given subject. This it does through 'Unity of Designation' and 'Display of Subject Relationships'.

By virtue of unity of designation or consistent use of subject headings, it unites at a single point all possible citations concerning documents relating to a particular referent. The purpose is not specification or codification of documents for the sake of specification but provision of generic survey.

B.C. Vickery[6] has pointed out to the following forms of generic survey from another view-point:

a. specific subject should be retrieved by any individual term or combination of terms it contains. For example, subject ABCD should be retrieved by A, B, C or D searched for seperately,

b. it should be retrieved on searching for a term which includes any of the terms in the subject. For example, ABCD should be retrieved by search for EAFG or FBGH, and

c. it should be retrieved on searching for terms co-ordinate with any term in it. For example, search for Streptomycine should retrieve penicillin which is co-ordinate with it under Antibiotics.

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6 B. C. Vickery, Classification and Indexing in Science, London, Butterworth, 1959.

Introducing the time element J. E. Holmstrom[7] divided generic survey into "current perusal" and "back reference". Wilson's alphabetical indexes are current perusal indexes and the card service of Engineering Index, intended for cumulative filing, is a back reference.

Display of relationships between subjects is an essential requirement for effective generic survey. In an alphabetico-specific subject catalogue, subject relations or displayed through cross-references instead of classification. "See references" in the dictionary catalogue provide the invisible wires that hold the whole structure together within the self-contained alphabet".[8]

## 3. - MEASURES OF EFFECTIVENESS

Having examined the functions of a subject index, it is pertinent to review the measures of effectiveness so that it could be assessed where the functions stand in the hierarchy of evaluation of a subject index.

Generally speaking there is no absolute criterion of measuring the effectiveness. The measures proposed in this respect are of relative nature. Effectiveness of one system can be measured in relation to another system or systems.

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7 J. E. Holmstrom, Records and Research in Engineering and Industrial Science, 2d ed., London, 1947, quoted by J. W. Metcalfe, Op.Cit.

8 G. Scheerer, "A Subject Catalogue Examined", in Library Quarterly, Vol.27, issue of July 1957, p. 189.

Mortimer Taube[9] argued that external evidence of users' satisfaction and internal characterstics of an information retrieval system both were required for complete evaluation of effectiveness. He suggested the following as internal characterstics:

1. Cost,
2. Size and rate of increase,
3. Time in compiling,
4. Time in retrieval,
5. Number of access points per item indexed,
6. Rate of obsolescence,
7. Logic in arrangement,
8. Universality, i.e., hospitability to ideas in different fields expressed in different languages at different times,
9. Adaptability to manual or mechanical searching and manipulation, such as permutation,
10. Simplicity for user,
11. Suitability for cumulative dissemination and use, and
12. Familiarity to user.

Taube has used these criteria to prove superiority of coordinate indexing.

Later commenting on the measures suggested by Taube, C. J. Frarey[10] emphasized the purpose of subject index as a

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9 Mortimer Taube, Studies in Coordinate Indexing, Washington, Documentation Inc., 1953, p. 96-110.

10 C. J. Frarey, "The Role of Research in Establishing Standards for Subject Headings", in Journal of Cataloguing and Classification, Vol.10, issue of Oct. 1954, p. 170-190.

criterion. It was necessary to determine whether the system did what it was supposed to do. Frarey meant that the functions of a subject index needed to be treated as primary criteria. But this could be hardly supported on logical grounds. The objectives are always subject to various limitations. The problem of purpose in hand cannot be treated in abstraction. The various factors need to be assigned relative weights. To take a fictitious example, a resourceful institution may be prepared to spend any amount of money but may be bent upon providing a quick retrieval system. In such a case, the time factor gets weightage.

In ASLIB Cranfield Research Project for the comparative evaluation of the Universal Decimal Classification, Faceted Classification, Alphabetical Subject List, and the Uniterm System, the following variables were used:

1. Time required for the preparation of each system,
2. Time required for locating and obtaining the desired information through use of each system,
3. Cost of equipment needed for each system,
4. Probability of each systems' producing the required answer,
5. Absence of irrelevant answers for each system,
6. Frequency of search, and
7. Potential value of information secured or potential value of failure to find it.

The variables mentioned at No.4 and 5 above, cover the criteria mentioned by Taube as "number of access points per item

| | | RELEVANCE OF DOCUMENTS WITH REGARD TO QUESTION | |
|---|---|---|---|
| | | RELEVANT | NOT RELEVANT |
| SYSTEM'S RESPONSE TO A QUESTION | ANSWER | a. (RELEVANT AND ANSWERED) | b. (NOT RELEVANT BUT ANSWERED) |
| | NO ANSWER | c. (RELEVANT BUT NOT ANSWERED) | d. (NOT RELEVANT AND NOT ANSWERED) |

FIG. 3: GOFFMAN-NEWILL MODEL FOR THE MEASURE OF EFFECTIVENESS OF AN INFORMATION RETRIEVAL SYSTEM.

indexed", "specificity of access points" and "logic in arrangement" and are more or less identical with the creterion emphasized by Frarey, viz., "the purpose of subject index". Later Goffman-Newill model[11] also emphasized testing of similar characterstics. In Goffman-Newill method, performance of a system is measured in terms of effectiveness (Es) comprising the sensitivity (Se) and specificity (Sp) of the system.

$$Es = Se + Sp$$

The sensitivity is the system's ability to retrieve relevant documents and the specificity is the system's ability not to retrieve non-relevant documents. Figure 3 on the opposite page gives a schematic representation of the method. Supposing the total file (collection) consists of documents a + b + c + d, the highest possible sensitivity can be:

$$Se = \frac{a}{a + c} = 1$$

It means that search retrieved all relevant documents available in the file. The lowest possible value can be zero, that is, search retrieving none of the relevant documents available in the file.

Similarly, the highest possible specificity can be:

$$Sp = \frac{d}{b + d} = 1$$

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11 W. Goffman and V. A. Newill, "Methodology for Test and Evaluation of Information Retrieval Systems", in Comparative Systems Laboratory Technical Report No.2, Cleveland, Centre for Documentation and Communication Research, Western Reserve University, 1964.

It means that search did not retrieve all non-relevant documents available in the file. The lowest possible value can be zero, that, is, search retrieved all non-relevant documents available in the file.

The value of effectiveness in the formula can vary between 0 and 2. In order to obtain a mathematically more elegant measure which can vary from -1 to +1, -1 is added to the above formula:

$$Es = Se + Sp - 1$$

or,

$$Es = \frac{a}{a + c} + \frac{d}{b + d} - 1$$

The above formula gives equal weight to retrieval of relevant documents and to suppressing of non-relevant documents.

In spite of the relativeness of various criteria of evaluation, it is evident that major functions of a subject index are pivotal to its effectiveness. On further telescoping, it can be generalized that user-relevance and system-relevance of a subject indexing method, in the order of priority, are the primary considerations for its effectiveness.

# CHAPTER IV

## IMPLICATIONS OF SUBJECT APPROACH

1) Factors popularizing the subject approach. - G. Scheerer wrote.

> The public libraries have ceased to be the people's universities. The people go to college. As centres of research and training in specialized skills, the universities have became vital for the very existence of our civilization. Subject exploration takes precedence over quick reference. [1]

Over and above the growing world literacy, the predominance of science and technology in society has worked emphatically to popularize, rather necessitate, the subject approach to information. Radical changes in research phenomena have also contributed significantly to change educated persons' attitude towards literature and information. Narrow specialization has become the order of the day. Team research is replacing the past solo-research. Relay-research, as opposed to parallel research, is becoming popular. Research is no more a self-sponsored activity. The national expenditures of money and manpower on research have made it a major segment of most of the national economies. At every level, the large numbers have added to the magnitude of the problem.

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1 G. Scheerer, "A Subject Catalogue Examined", in Library Quarterly, Vol. 27, issue of July 1957, p. 188.

## 2. - THE UNIVERSE OF SUBJECTS.

Any system of information retrival designed for subject approach need to take cognizance not only of the mode of formation of subjects but also of the frequency of incidence of various modes of such formation.

Subjects are formed due to association, combination and superimposition of concepts which are in turn formed by a similar process of percepts which can be called the thought units. Due to multi-level interaction of subjects and environment, the fallow regions in the universe of subjects are filled up and a continuum of subjects is formed.

The recent changes have rendered the universe of subjects dynamically turbulent. D. de Solla Price[2] and G. Holton[3] have reported a few of such trends. Development of the universe of subjects was much greater after 1950 than early 1900's. Disturbances were more frequent in Natural Sciences than in Humanities and are appreciable in Social Sciences. Isolates in 'Personality' facet of subject change more frequently and are most numerous. Isolates in other facets are largely common isolates. These developments in the universe of subjects are significant to subject heading work so much so that the methodology of subject access has to be compatible with dynamism of

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2 D. de Solla Price, Calculus of Science, New York, Interscience, 1963, p. 37-43.

3 G. Holton, Scientific research and scholarship, Dacdalus, Spring, 1962, p. 362-399.

the universe of subjects. For example, vocabulary in various subject fields needs to be controlled through thesaurus approach.

3. - SUBJECT ANALYSIS.

It is an activity basic to any system designed to provide subject acess, whether it be a classed catalogue or an alphabetical subject index. What a classed catalogue does through classification, it is done by subject headings via the notation of common alphabet. Even in the realm of alphabetical subject index, subject analysis is not the same to all people in all places at all times.[4] To one section, it is conventional analysis of complex subjects of documents. It is so meant in Europe. To another group, it is bibliographical analysis of documents into articles, chapters and so on, then these components are treated for subject entry purposes. It is so understood in America. There is still another school of thought. They name subject analysis as information analysis, wherein information or subject matter is distinguished within a document without further bibliographical distinction. For example, information on 'Cork substitutes' in an article on 'Wine bottling' in a Wine trade journal. What we are indexing here are not subjects of information, but information itself by subjects, subject-aspects, processes and document forms.

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4 J. W. Metcalfe, Information Indexing and Subject Cataloguing, New York, Scarecrow, 1957, p. 223.

As commented by J. W. Metcalfe,[5] J. H. Shera distinguished between the conventional subject analysis and information indexing in terms of 'thought units', 'information units' and 'graphic units'. By thought units he meant a concept or constellation of concepts meaningful to the scholar-as-user. He prescribed that the task of documentation is to match the concepts with appropriate expressions in literature. Deriving from Hans Trebst, P. C. Coetzee[6] distinguished between thought units in another way. Subjects in the sense of a totality of assertions, such as 'Physics', is different from the subject in the sense of the object discussed, such as 'Mathematical Physics'. It has a theoretic connection or tie. Trebst calls it an 'intellectual form'. By use of 'form' he meant 'structure', but his critics interpreted it to be a 'point of view'.

On analysing, we find three elements in any information indexing system. Firstly, there are subjects of enquiry. Normally these are not precise. Being expressed in words of a natural language, they can be a source of uncertainly and error. Secondly, there are subject heading classes under which documents are indicated. Thirdly, there are subjects of the indicated (indexed) documents. Now, efficiency of the system depends upon the equilibrium among the three.

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5 Op. Cit.

6 Hans Trebst, Studien zu einer analytischen sachkatalog, Leipzig, 1931, quoted by S. Runge, "Some Recent Developments in Subject Cataloguing in Germany", in Library Quarterly, Vol. 11, issue of Jan. 1941, p. 46-68.

The concept of 'milieu of a subject' is also pertinent to subject analysis. P. C. Coetzee has described milieu as a structure built up by a large number of interrelated objects. One of these objects, or the milieu as a whole, can become a subject. For example, 'Greek morals in the time of Alcibiades'. Here 'morals' is subject, Greece is regional milieu and 5th century B.C. is chronological milieu. He points out that there can be three types of relations between the milieu and its constituent objects.

i) The object can be part of the milieu.
Ex. Divorce in France.
Here the milieu is a limiting factor.

ii) The object can be function of the milieu.
Ex. Gr. Brit's intervention.

iii) The milieu can be subjected to same function or condition.
Ex. Dehydration in South Africa.

He emphasizes that subject heading should be indicative of also the milieu of the subject. Compared with other conventional terms of subject analysis, such as subject relationship, aspect, facet etc., the term milieu is more comprehensive in scope, but Coetzee's suggestion also to show in subject heading the relation of the constituent to its milieu is too difficult to be expressed in pure alphabetical notation. Variety of subject relationships is so great and complex that in devising a mechanism for display of relationships, subject heading theorists like J. E. L. Furradane, dealt with later in this study, have been dragged away from useful principles such as simplicity, usage,

efficiency of retrival etc. It was because of these complications that M.Taube devised coordinate indexing which ignores subject relationship in the structure of subject headings and leaves it to the method of coordination performed by user. It is altogether a different matter to take cognizance of subject relations, or so to say, of milieu and the constituent subject in determining the specificity of the terms to be chosen for subject heading. No subject heading theorist has so far objected nor shall ever do to display subject relationships so long as the words of a natural language can accommodate such display direct in a subject heading or indirectly through use of cross-references. Our endeavour here is to be hospitable to mechanism of systematization but only within the bonds of a natural language for the simple reason that alphabetical arrangement has withstood through out the times to the satisfaction of users whether they be laymen or specialists.

## 4. - DIVERSITY OF SUBJECT APPROACH.

Searching the titles under a subject was a simpler affair in the times of C. A. Cutter, J. Kaiser and others than it is today. The school of specific subject heading which originated with Cutter contemplated the books of those days. The multi-faceted books and micro-documents of today have posed new problems and given new dimensions not only to subject heading work, but also to users' subject approach.

Users are familiar with two types of significant traces or points of reference. Users, who have already discovered the citations of the books they need, normally approach their material through formal traces' (traces of form) based on characteristics of origin, such as author, title, publisher, date of publication, etc. When no formal traces are known, they approach through material traces based on bibliographical form, topic, or relation to a science or branch of knowledge.

There are three types of approaches concerning the material traces.

i) Subject approach: normally an uninformed user approaches the subject index through a specific topic.

ii) Systematic approach: users having adequate academic background approach through placing the required information within the frame of a science or a branch of knowledge. All educated men, to use Margaret Mann's phrase, 'almost unconsciously classify their material'.

iii) Class approach: this is an approach by way of classification usually made by such users who are a little conversant with the system they use.

The technological advances have made possible another approach, that is, mechanical selection based on quick serial examination or sorting method, i.e., accepting or rejecting the documents. Computer search of data base is an example of such an approach.

## 5. - INSTRUMENTS OF SUBJECT CONTROL OF INFORMATION.

There are alphabetical devices. Specific collections or literature of specific subject field are covered by alphabetical subject catalogues or indexes. The printed dictionary catalogues of the Library of Congress and Library Literature can be quoted as examples of these two types. There are also alphabetical subject indexes to periodical literature not restricted to any specific subject field. Poole's Index to Periodicals and Library Association's Subject Index to Periodicals are indexes of this type. It will not be out of place, if a casual mention is made of alphabetical devices which have a similar purpose, but are different in the form of subject representation. They are key-word indexes, citation indexes, abstracts, and full-text microforms attached to the card field of uniterm index.

There are also devices other than alphabetical. As a substitute for dictionary catalogue, a systematic (logical ) arrangement is preferred for compiling a subject catalogue. Many classed catalogues of library collections and periodical literature fall into this category. The British National Bibliography (BNB) and the Library Science Abstracts are the well known examples. In order to combine the merits of an alphabetical index and of a classed catalogue, a via media has been found in the shape of alphabetico-classed catalogue. The Engineering Index is of this type. M. Taube devised his Uniterm Indexing using the principle of coordination of terms. This is now gaining

popularity as a quick information retrieval system. Geodex, a subject-alert system in Earth Sciences, uses the Uniterm Indexing method. Subject bibliographies also provide subject access to literature. Besides, mechanical and electronic techniques also have been applied to devise instruments of subject control of information, such as the Permutable Indexing, punched-card system, computerised data-base with distant terminals. These are basically sorting operations - accepting or rejecting the representations of documents examining serially. Permutable Indexing is based on key-word indexing method performed through computer print-outs, each line displaying a significant word in the title.

# CHAPTER V

## DEVELOPMENT OF SUBJECT HEADING THOUGHT

1) Preliminaries. - The term subject heading is so commonly used that it might appear unnecessary to define it. But it is used in a variety of senses so much so that it has become a misnomer. It refers not only to subjects of discussion but also covers bibliographical forms and chronological and regional ties of subjects. The German term "schlagwort',[1] the Dutch 'trefworrd', and the Spanish 'Epigrafe' do not refer to any specific type of point of reference. The term subject heading is superior to 'Catchward' as it is free of any tie with title page. In simple words, subject headings are terms denoting subjects under which material is entered in a catalogue. They are arranged alphabetically together with the references which integrate them. P. C. Coetzee defined it in more precise terms:

> Semantically viewed, a subject heading is a concise, elliptic communication, referring to the relevant characteristics of bibliographic unit considered as a whole and, anticipating future use by readers as a point of reference, inter alia by means of unity of designation and the employment of expressions lending themselves to alphabetization.[2]

C. J. Frarey has further elaborated the connotation of subject heading as:

> a word or verbal expression deliberately chosen from among various alternatives to express the particular content of the material which it describes and which will be:

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1 D. J. Haykin has given the German equivalent of subject heading as stichwort.

2 P. C. Coetzee, "Syntactics and Semantics of the subject headings", in Mousaion, No. 23, 1957, p. 9.

i) in harmony with the usage of the audience to whom it is addressed,

ii) accurate and precise in its specification of the exact subject of the material,

iii) uniform in the sense that the same word or verbal experssion will be used consistently to describe the same subject, and

iv) amenable to integration with other subject headings to provide a usable arrangement.[3]

There are numerous types of subject headings in use. M. L. Prevost[4] enumerated twenty-one types under the three broad semantic categories, namely, subject headings for names of places or persons, for names of events, and for subjects other than names of places, persons or events. B. C. Vickery[5] has identified the syntactic types as single words, single words qualified by paranthesis, adjectival phrases, prepositional phrases, and formalized non-grammatical headings. For controlling the vocabulary of an alphabetical subject index, the types of subject headings to be used need to be restricted. Too many forms creat confusion and uncertainty.

2) The main streams of subject heading theories. - The two approaches, expediency approach[6] and systematic approach, constitute the main streams of alphabetical subject heading thought.

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3 C. J. Frarey, Subject headings, New Brunswick, N. J. Rutgers University Press, 1960, p. 5-6.

4 M. L. Prevost, "An Approach to Theory and Method in General Subject Headings", in Library Quarterly, Vol. 16, 1946, p. 140-151.

5 B. C. Vickery, Classification and Indexing in Science, 2d ed., London, Butterworth, 1959.

6 Op. Cit. p. 140.

For the purposes of this study, the systematic approach does not imply a classed arrangement of subject index. It means introducing a system and logic in choice and structure of alphabetical subject headings.

i) The expediency approach. - Reader being the focus of subject heading work, all entries which users may conceivably look are made, even if they demand a sacrifice of system and simplicity. Neither logic nor consistency but usefulness carries. This is based on the basic principle that "the public is always right". Since all enquiries are initially in natural language of the user, alphabetical subject entries based on usage principle in choice and structure are made. These have proved to be helpful and comparatively simple. Metcalfe does not seem to have exaggerated in his remarks about the alphabetical arrangement: "[...]in effect it is the most important high precision instrument ever invented by man and familiarity with it should not be allowed to breed contempt".[7]

ii) Systematic approach. - As opposed to expediency approach, choice and structure of subject headings can be subjected to logic and system. The urge for systematization has led subject heading theorists like P. C. Coetzee to reduce subject heading work to the exactness of a chemical formula and certain

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7 J. W. Metcalfe, Subject Classifying and Indexing of Libraries and Literature, New York, Scareerow, 1959, p. 21.

others like Ranganathan to have it based on a classification scheme. Attempts were made from time to time, also to combine both the expediency and the systematic approaches, but with little success. Cutter's Rules and the Library of Congress subject heading practice are the great examples of such attempts.

Since the medium of communication is that of words and concepts, the method must be that of logic. Choice and structure of subject headings should be systematic and logical. It provides a sound grammar for subject headings. Subject relations for the purposes of generic survey are best displayed in a totality of logical headings only.

In expediency approach, subject entries get scattered all through the alphabet. The scattering combined with the largeness of catalogue becomes a problem. D. J. Haykin has quoted an example from the public catalogue of the Library of Congress:

> As an extreme case of the number of entries in the catalog intervening between Civil defense and Civilian defense may be cited the public catalog of the Library of Congress, where no less than 10,646 subject entries and references and 720 title entries occur in this space, including by way of example, 3100 entries under the heading Civil law, 4500 under Civil procedure and 2000 under Civil service. [8]

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8 D. J. Haykin, Subject Headings: a Practical Guide, Washington, G.P.O., 1951, p. 20.

This example also shows that lavish provision for all sorts of user's approach make the catalogue unweildy and the searching cumbersome. Linguistic associations between documents cannot lead to a satisfactory definition of relevance. For instance, presence or absence of the word "information" in the title, or abstract or in the total text would not be a reliable criterion on which to base the inclusion or exclusion of the documents. At the same time, the documents involving the word "information" may be totally irrelevant to information theory.

Julia Pettee wrote:

> We all begin our subject lists with the alphabetical cart before the horse but we soon discover that though the cart must carry the load, it is the horse that must do the pulling, and the horse is the basic principle of an orderly systematic arrangement of subject material. [9]

It appears that logical confusion in reader is assumed as an execuse for logical confusion in cataloguer. Presuming that neither compiler nor user can make intelligent use of the difference between a comma and a dash, it is not necessary to bring subject cataloguing down to the lowest common average. Alphabetical subject catalogue is supported, also because it works. If we continue to like an out-dated approach ignoring the needs of modern research, the remarks which J. W. Metcalfe made about

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9 B. C. Vickery, Classification and Indexing in Science, London, Butterworth, 1958, p. 5, quoted without any reference to the original.

J. D. Brown's "Subject classification" apply to this situation as well: "Apparently SC has worked and still works in some libraries, but so have and do some motor cars of the same dates once a year on the Brighton Road".[10]

3) THE REGIONAL TRENDS.

The development of subject cataloguing has regional factors also.[11] Alphabetical subject catalogue with consistent form of headings without regard to logic has been most popular in the U.S. Cutter codified alphabetical subject headings in 1876 and Library of Congress first published its subject heading list, from 1909-14 which made use of Cutter's rules on a large scale. In U.K., subject catalogue developed by means of a classified catalogue. Germany developed catchword title entries for a subject catalogue. The "Schlagwort" catalogues of Germany started in the 19th century. Italy favoured alphabetical subject catalogue through Vatican Norme.

4) IMPACT OF CLASSIFICATION THEORIES AND METAPHYSICAL THEORIES OF KNOWLEDGE.

The "Philosophical Classification" of Richardson (born 1859) was a subject classification, not information classification by subjects. Influenced by Darwin's "Origin of species" published in 1859, he applied the philosophy of evolution to bibliographical

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10 J. W. Metcalfe, Information Indexing and Subject Cataloguing, New York, Scarecrow, 1957, p. 275-276.

11 J. Lee Harris, Subject Analysis: Computer Implications of Rigorous Definition, Metuchen, N. J., Scarecrow, 1970, p. 15.

classification so as to conform to the "order of the sciences". Wyndham Hulme criticised Richardson in his second work "Principles of book classification" published in 1911-12, and asserted that subject matter was almost infinitely indivisible. Savage gave him a full textbook treatment. In his book "Principles of Science", W. S. Jevons (1835-1882) made a cryptic statement that classification of books was a logical absurdity. This was often quoted out of context. He argued that it was difficult to classify sciences because they were so much interrelated; more so with books. Later J. H. Shera interpreted that Jevons meant that contents of books were poly-dimensional or poly-topical. J. D. Brown (born 1862), known for his "Subject classification", rejected the conventional classification based on logical association of main subject fields. He emphasized on a convenient sequence of subject fields rather than logical one. W. C. Berwick Sayers attempted to reconcile Richardson's metaphysics with Jevon's logic. He used the "Five Predicables" and got at the idea of "gradation by speciality" and laid down his "Canons of Classification" in a paper of identical title read to Library Association, London, in 1907. H. E. Bliss, the author of "Bibliographic Classification" put forth the "Consensus Theory" for the order of the sciences. He argued that subject fields should be arranged in a classification schedule in accordance with the workers in educational and scientific occupation.

The classification theories which evolved through the ages influenced the subject indexing theories also. Concealed classification in an alphabetical subject catalogue in the shape of sub-division, inversion, qualification, cross-references, etc. is

the evidence of such impact. The theory of "the order of the sciences" was an attempt to establish relations between main subject fields. This influenced the later thinking and resulted in providing a clear mechanism for display of subject relations in a subject catalogue. Hulme's theory that subject matter was almost infinitely indivisible and Jevon's assertion that classification of books was a logical absurdity appear to have moved the compilers and the users of subject catalogue towards the expediency approach. J. D. Brown's Subject Classification based on the negation of subject associations at large and later Sayers' "Five Predicebles" can be termed as the beginning of the thinking which led to free-faceting advocated by S. R. Ranganathan and later exploited further in coordinate indexing by Mortimer Taube.

## 5. - SUBJECT INDEXING THEORIES.

i) The school of expediency approach. - As a finding aid, inventories were the earliest bibliographical tools. Then came the "order by classes". Later, the catchword title entry and relative indexes to hierarchical classification schemes, such as the relative index to Dewey Decimal Classification were developed which are believed to be the two predecessors of alphabetio-specific subject headings.

Martin Schrettinger, a Bavarian monk - Librarian, published his thoughts on the systematic vs. alphabetical catalogue in 1829[12]

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12 S. L. Jackson, "Schrettinger on Class and the Subject Headings: a Note on Early 19th Century Thinking", in Library Resources and Technical Services, Vol. 14, issue of July 1970, p. 579-581.

and pleaded for subject guidance in alphabetical array under the label of "Real catalog". But selection of single term to be used uniformly to describe a subject did not come into practice until 1861 when Ezra Abbot began the card subject index for the Harvard College Library.[13] He established the principle that every book which had a subject should have a subject entry and such entry was to be determined by the contents of the book and to be entirely independent of the wording of the title.

Cutter was a land mark in subject heading work. He exerted lasting influence as a promulgator of expediencey approach. His twenty-eight rules for subject entry[14] identified the chief issues of subject cataloguing and established the following principles:

a. Usage: reader being the focus of all cataloguing practice, usage should guide the formulation of subject headings.

b. Direct entry: adjectivel phrases should be entered directly, except when another word is decidedly more significant.

c. Term-Significance: choice and structure of a subject heading should be based on the significance of the terms indicating the subject of the document.

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13 C. A. Cutter, "Library Catalogs", in U.S. Bureau of Education, Public Libraries in the U.S.A., Washington, G.P.O., 1876, p. 535-540.

14 C. A. Cutter, Rules for a Dictionary Catalog, 4th ed., Washington, G.P.O., 1904.

d. Specific Entry: subject entry should be specific, that is, a document should be entered under its subject heading, not under the heading which includes that subject.

e. Unity of Designation: use of subject headings should be consistent so that all books which deal mainly with the same subject are brought together under one heading.

f. Multiple Entry: a document can be indexed under more than one subject headings, if required.

He resolved clearly the issues between title and subject entries and between specific and class entries, but did not solve the conflict of "usage" with a consistant grammer of subject headings.

Later Wyndham Hulme added the concept of "Literary warrant".[15] No concept was to appear as a subject heading in subject catalogue, unless the literature on that concept was represented in the collection.

Among the writers of recent past, J. W. Metcalfe was a strong supporter of dictionery catalogue. In this process, he elaborated the alphabetico-specific subject heading theory. He alleged that systematic indexing is against usage. Criticising Ranganathan's Chain Procedure, he stated that it was a labour and space consuming device, taking up 12% of the total cataloguing space in a catalogue.[16]

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15 J. W. Metcalfe, Information Indexing and Subject Cataloguing, Op. Cit., p. 233.

16 Op. Cit., p. 160.

ii) The school of systematic arrangement. - The quest for systematization of subject heading work can be said with certainty to start with J. C. Schwartz in prescribing the 'Noun Rule' for formulation of subject headings. This was a significant departure from the conventional principle of direct entry. In case of an adjectival phrase, noun is placed first as an entry word followed by adjective in turn changed to noun form as a subdivision using a dash. For example, the subject 'International relations' will get a heading like 'Nations - Interrelations'. The intention was to bring the subject heading work to a level of exactness. As Schwartz puts it, reader would know where he was or where he has to go. He used this principle in his "Catalogue of the New York Apprentices' Library".

Cutter rejected this principle, as it introduced class entry and would put subjects under words where nobody unacquainted with the rule would expect to find them. Later in 1946, M. L. Prevost suggested a return to the Noun Rule with modification given in her rules.[17] In order to modify a subhead, she recommended insertion of a preposition or prepositional phrase in parenthesis disregarded in filing. For example, 'Libraries - Science (of) - Schools' and 'Accounting - (for the) Executive'. She ruled out all composite headings and running headings

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17 M.L. Prevost, "An Approach to Theory and Method in General Subject Heading", in Library Quarterly, Vol.16, 1946, p.149 & 150.

except where the name of an event takes the running form. Such headings can be replaced in subhead form by a brief phrase in paranthesis. For example, for 'Education and Democracy', the subject heading will be 'Education - (relation to) Democracy'.

J. Kaiser, was the librarian successively of the Pheladelphia Commercial Museum and the Tariff Commission, London.[18] He further expanded the Noun Rule in 1911. He recommended that a subject should be broken down into 'concrete' and 'process' terms, making the former the entry element. He also provided for entry under place name. Being an improvement on Noun Rule, it provided an exact grammar for specific entry. Kaiser took up the problem of relative importance of components of a compound subject heading at the point where Cutter had left it. But Kaiser's 'Concrete - Process' formula ignored usage and introduced classificatory order into dictionary catalogue. Verbal telescoping of terms into two great classes was not the answer to all the problems.

Hans Trebst[19] contributed significantly by recommending that a statement of subject should be first formulated and then its components should be arranged into a subject heading in a prescribed order. For this reason P. C. Coetzee names him as the pioneer of the scientific heuristics of subject headings. Deriving from him, Coetzee proposed elaborate formulary for

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18 J. Kaiser, Systematic Indexing, London, Pitman, 1911.

19 Hans Trebst, Studien Zu einer analytischen sachkatalog, Leipzig, 1931. His system is described in S. Runge, "Some Recent Developments in Subject Cataloguing in Germany", in Library Quarterly, January 1941, p. 46-68.

rationalising the subject heading structure. Identifying the characterstics of books pertaining to their origin, method of presentation, subject-matter, and milieu of the subject, he assigned symbols for each of them and prescribed formula for a fixed component order in headings. He distinguished the books into two major categories, namely, the normative books, like 'An Anthology of English Poems', and discursive books, like 'Introduction to Physics' and proposed separate formula for each category and its sections. In case of discursive books 'm' (milieu) terms are always primary. In the absence of 'm' terms, 'S' (subject relation) terms take precedence. In the absence of 'm' and 'S' terms, 'tr' (theoretic tie) terms are primary. In the absence of all the three, 'f' terms become primary. For example, 'Economic conditions in France' is analysed as 'm [S]' and gets a heading like 'France (Economic conditions).

S. R. Ranganathan recommended the "Chain Procedure" as a solution to subject heading problems. He defined Chain Procedure as :

> [...] a device to derive subject headings from class number mechanically - that is without reading the book and determining the subject(s) of a document$.[20]

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20 S. R. Ranganathan, "Chain Procedure and Dictionary Catalogue", in Annals of Library Science, Vol.1, issue of December 1954, p.216.

Each class number is analysed as a series of links (steps) and subject word entries are made for each significant link beginning with the last link. Translation of notational entry word is called "Featuring" and the method used "Chain Procedure". For example, featuring by Chain Procedure for the subject 'Presbyterian Churches in the United States', classified in Colon Classification as Q 64.73 and in Dewey Decimal Classification as 285.1, will be as follows :

| By Colon Classification | | | Step No. | By Dewey Decimal Classification | | |
|---|---|---|---|---|---|---|
| Q | = | Religion | 1 | 200 | = | Religion |
| Q6 | = | Christianity | 2 | 280 | = | Christian churches and sects |
| Q64 | = | Presbyterian | 3 | 285 | = | Presbyterian churches |
| Q64. | = | False link | 4 | 285. | = | False link |
| Q64.7 | = | America | 5 | 285.1 | = | U.S.A. |
| Q64.73 | = | United States | 6 | | | |

Each component heading is strictly to be a single noun in nominative case, except when a qualifying adjective is necessary. Ex : Algebraic equation. If other forms of nouns are used, alphabetical scattering gets intensified and consistency also become difficult, particularly in languages which use inflexions of the stem to denote different cases and allow formation of a single word by the coalescence of

several nouns, such as Sanskrit, Russian, German, etc.

Haykin says : Ranganathan "has gone further than any one else in introducing order and logic into librarianship".[21] Ranganathan's five categories of terms (Personality, Matter, Energy, Space and Time) are a useful improvement on Kaiser's pair of "Concrete" and "Process". The 'Personality' facet is equivalent to Kaiser's "Concrete" but can also denote functions, use, or product.

Chain Procedure's large scale use with Dewey Decimal Classification started in BNB (British National Bibliography) in 1951. It can be used with any other scheme of classification. J. Mills has worked out examples with UDC(Universal Decimal Classification), L.C. (Library of Congress), BC (Bibliographic Classification of Bliss) and SC (Subject Classification of J.D. Brown) also. But it can give good results, if class number is co-extensive with the subject of the book so that subject heading could represent the entire thought content, as B.C.Vickery puts it, "all its foci, all its crisscross of subject and forms and all its interlacings - fully and literally".

Ranganathan himself admitted that Chain Procedure did not provide commonly sought headings for a dictionery catalogue;

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21 D. J. Haykin, Subject Headings : a Practical Guide, Washington, G.P.O., 1951, p.14.

hence, he developed the "Postulates of Facet Analysis" for choice of specific subject and the "Principles of Facet Sequence"[22] for rendering the name of the specific subject so that the entry so obtained could correspond to a specific subject heading of dictionary catalogue. He leaves the ground open for further research by admitting that the sequence of words in a multiple subject heading is not yet known to be unique. His system is "one possible syntax".

He defined Facet Analysis as recognizing the basic subject and each of the isolates of a subject and arranging them in preferred sequence in accordance with prescribed rules. The method comprises recommendations for proceeding step by step for choice and rendering of subject headings :

Step I : arriving at full title from the raw title given in the document by breaking down composite words and filling up ellipses (basic facet will be normally absent);

Step II : extracting Kernel title by removing puffs and replacing nominative forms of nounds

Step III: formulating the analysed title by determining the word-order with the help of "Wall-picture" principle, and

Step IV : arriving at the transformed title, i.e., conversion of titles from their initial version to the version in the system provided.

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22 S. R. Ranganathan, "Subject Headings and Facet Analysis", in nal of Documentation, Vol.,20, issue of September 1964, p.1 9.

Step III and IV can be merged into a single step. The four steps recommended by Ranganathan for the choice of specific title of a document are similar to the concept of formulation of subject statement originated by Hans Trebst and later elaborated by P. C. Coetzee. Ranganathan has provided for two options for rendering of a subject heading. Components of multiple subject heading can be arranged either in the order of increasing concreteness (intension) of terms, called "Forward Rendering", or, in the order of decreasing concreteness (intension) of terms, called "Reverse Rendering".

A specific document on a multi-faceted subject will be taken to demonstrate the procedure : 'Some Approaches to the Permanent Flame-proofing of Cotton : Systems Containing Phosphorus'.

Choice of specific subject :

Step I : Full title : Some Approaches to the Permanent Flame-proofing in the Finishing of Cotton Fabrics : Systems Containing Phosphorus (the underlined terms are the filled-up terms).

Step II : Kernel title : Flame-proof. Finishing. Cotton. Fabrics. Phosphorus.

Step III: Analysed title } Fabrics. Cotton. } Finishing. Flame-
Step IV : Transformed title } proof. Phosphorus.

'Finishing' being the 'Energy' facet of the subject, each of the remaining facets, except the basic facet, gets a position in the heading relative to the Energy facet, according to "Wall-picture" principle. If two facets of a subject are so related that the concept behind the one will not be operative unless the concept behind the other is conceded, then the former should precede the latter. In the above example, the concept 'Finishing' does not become operative unless the concept 'Cotton' is thought of; hence, 'Cotton' precedes 'Finishing' and so on.

Rendering the name of specific subject :

Forward rendering : 'Fabrics. Cotton. Finishing. Flame-proof. Phosphorus'.

Reverse rendering : 'Phosphorus. Flame-proof. Finishing. Cotton. Fabrics'.

Ranganathan has provided two checks for the choice of first heading, namely, the "Canon of Prepotence" and the "Canon ofSought-Heading". The former demands that user should have the least number of entries to be looked into in order to locate his document. For the above example, he has given the following potency-count[23] :

| First Heading | No. of entries | Potency |
|---|---|---|
| Fabrics | 200 | 1/200 |
| Cotton | 37 | 1/37 |
| Finishing | 71 | 1/71 |
| Flame-proof | 2 | 1/2 |
| Phosphorus | 8 | 1/8 |

Therefore, 'Flame-proof' will have to be chosen as the first-heading.

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23 Based on the entries in British Technology Index, 1962.

"Canon of Sought-Heading" claims that such term should be chosen as first heading that a majority of users would like to look for the document under it. This can be either based on an objective statistical survey or an educated guess based on experience. British Technology Index prefers the first heading as in Forward Rendering. The followers of the School of Specific Subject Heading would prefer the first heading as in reverse rendering.

Having established the choice and rendering of specific subject heading,'See also' references are derived from the specific subject heading with the help of Chain Procedure mechanically without going into the semantics of the headings so selected. In the above example, the following will be the cross-references :

| | |
|---|---|
| 1. Cotton. Fabrics<br>2. Finishing. Cotton. Fabrics<br>3. Flame-proof. Finishing. Cotton. Fabrics<br>4. Phosphorus. Flame-proof. Finishing. Cotton. Fabrics. | In case of Forward Rendering, when the first heading is 'Fabrics. Cotton. Finishing. Flame - proof. Phosphorus.' |
| 1. Flame-proof. Finishing. Cotton. Fabrics<br>2. Finishing. Cotton. Fabrics<br>3. Cotton. Fabrics<br>4. Fabrics | In case of Reverse Rendering, when the first heading is 'Phosphorus. Flame-proof. Finishing. Cotton. Fabrics.' |

In certain cases, omission of Kernel terms either in a specific subject entry or cross reference entry has been provided for, depending upon the purpose of the subject index in hand. If it is a documentation list for a specialist reader in a subject field, "Cotton fabrics" for instance, the two headings "Fabrics" and "Cotton" can be dropped. If it is a general subject index such as the B.T.I. (British Technology Index), the first heading "Fabrics" even in Forward Rendering should be used. Also the common isolate terms denoting 'Personality', 'Energy', 'Property', or 'Geographical Area' or 'Year' can be dropped. For instance, if the document indexed is a bibliography, there need not be entry under Bibliography, except for special reasons as regional studies.

Later J. E. L. Farradane[24] scrutinized not the component words of subject heading, but the relationships between them. Kaiser's and Ranganathan's methods are classifications of isolated terms into categories, recommending a given order of precedence. Farradane emphasized that nature of relationships between terms should also be indicated by using specific symbols. He recommended that isolates - uniquely definable items of knowledge which must be nouns explicit or implicit - should be arranged into an analet by inserting the operators in between them to show the nature of relations in which isolates stand. For example,

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24 J.E.L. Farradane, "A Scientific Theory of Classification and Indexing", in Journal of Documentation, Vol.6, 1950, p.83-99 and Vol.8, 1952, p.73-92.

the subject "Oil-in-water Emulsions" will get an analet 'Emulsions /(oil /+ water'. The symbol '/(' stand for the operator "Appurtenance" (belonging to ), and '/+' stands for the operator "Dimensional", a non-distinct temporary relation in time and space. He prescribed nine types of operators, or relational symbols and claimed that his system provided an irreproachably logical index.

J. E. Holmstrom[25] exploited the display of relationships with a different type of relational symbols. He devised an alphabetical classification by subject headings and named it as "Classification under Ramified Keywords". One of the following letters of alphabet define the type of relationship between the main concept and the secondary concept :

| | | | | | |
|---|---|---|---|---|---|
| A | = | action | P | = | personal name |
| C | = | corporate name | Q | = | quality |
| E | = | equipment | S | = | substance |
| G | = | geographical name | T | = | title of a publication on what is described |

On the contrary, E. J. Coates[26] was quite clear on syntactical issues. He recommended two approaches to word-order in a multiple subject heading, namely, term-significance

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25 J. E. Holmstrom, Facts, Files & Action, Vol.2, London, 1953, p.70-83, quoted by Eric de Grolier, Astudy of General Categories Applicable to Classification & Coding in Documentation, Paris, Unesco, 1962, p.92.

26 Eric J. Coates, Subject Catalogues : Heading & Structure, London, Library Association, 1960.

and term-relationship. According to him the most significant term in a composite subject heading is the one which is most readily available to the memory of the enquirer. Based on this, he prescribed the formula "Thing/Material/Action". For example, a document on 'Deterioration of Oil Transformers' will get the following heading :

| Transformer, | Oil, | Deterioration |
|---|---|---|
| Thing | Material | Action |

Significance-order and natural order do not reconcile in all cases. For example, the phrases "Conveyor belt" and "belt Conveyor" use the same pair of terms but convey two different concepts, because relationship between the components of each phrase is not the same. This shows that the significance formula is not an answer to all problems of word-order in a subject heading. It is therefore necessary to consider to what extent relationship between terms leads to modification of the significance formula "Thing/Material/Action".

Relationships between terms are rendered in natural language by use of verbs and prepositions. If a preposition is not apparent, it is implied and can be amplified. For example, the phrase "Conveyor belt" can be amplified as "Belt of conveyor" and the "Belt Conveyor" as "Conveyor with belt". Here the prepositions "of" and "with" indicate how the component words are related. He gave the general formula as : Reverse the order of components in an amplified relational phrase. For example, "Stability of flight" can be indexed

under "Flight, Stability". In an elaborate table, he prescribed word-order for amplified relational phrases containing the prepositions "of", "for", "by", "with"and "against" and examined whether or not it agrees with significance-order.

B. C. Vickery[27] supported the display of subject relationships as a necessary feature of a subject index, and advocated "full facilities of reference". This was a development on Cutter's concept of "facility of reference". According to him, each term in a subject heading must constitute a valency - a magnetic pole - by which the whole reference may be drawn out. For example, a subject ABCD should be retrieved against search under any of its component terms A, B, C, and D. Each term should be retrieved against search under any other term which includes it, say EAGF. It should also provide some degree of reference to each term from the terms coordinate to it in array.

The later suggestion of "rotated entry" made by C. L. Bernier[28] for cross-references is an extension of the principle of "full facilities of reference" based on the argument that the user cannot be expected to master the rules of word-order in a subject heading.

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27 B. C. Vickery, Systematic Subject Indexing in Science, 2nd Ed., London, Butterworth, 1959.

28 C. L. Bernier, "Subject-Index Production", in Library Trends, Vol.16, issue of January 1968, p.388-397.

iii) The new trends. - The new trends in subject indexing have arisen due to semantic and syntactic complexities of the conventional alphabetical subject indexing. Of these, the problems of word-order in a multiple subject heading and display of subject relationships were the major sources of complication, avoidance of which led the modern indexing theorists to devise systems which do not suffer with pre-coordination of word-elements in a subject heading. Mortimer Taube's "Uniterm System for Coordinate Indexing", H. P. Luhn's suggestion for use of thesaurus as information retrieval tool, C. N. Mooers' "Zatocoding", Samain's mechanical selection, etc., are some of the outstanding contributions of this nature.

a) "Uniterm System for Coordinate Indexing". - The number of words people use is much less than the number of phrases they use to describe things and concepts. It is estimated that working vocabulary of an average college trained person is about two thousand words strong and in a large library, 50,000 subject headings used for cataloguing the documents contained only 3600 words used in various combinations[29].

In "Uniterm System for Coordinate Indexing" devised by Mortimer Taube in 1953[30], information-content of the documents in a collection is described by uniterms which are chiefly single-word subject headings for unit concepts. Search medium is the

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29 The Uniterm System of Indexing : Operating Manual, Washington Documentation Inc.(no date) p.14.

30 J. C. Costello, Jr., "Uniterm Indexing Principles, Problems and Solutions", in American Documentation, Vol.12, issue of January 1961, p.20-26.

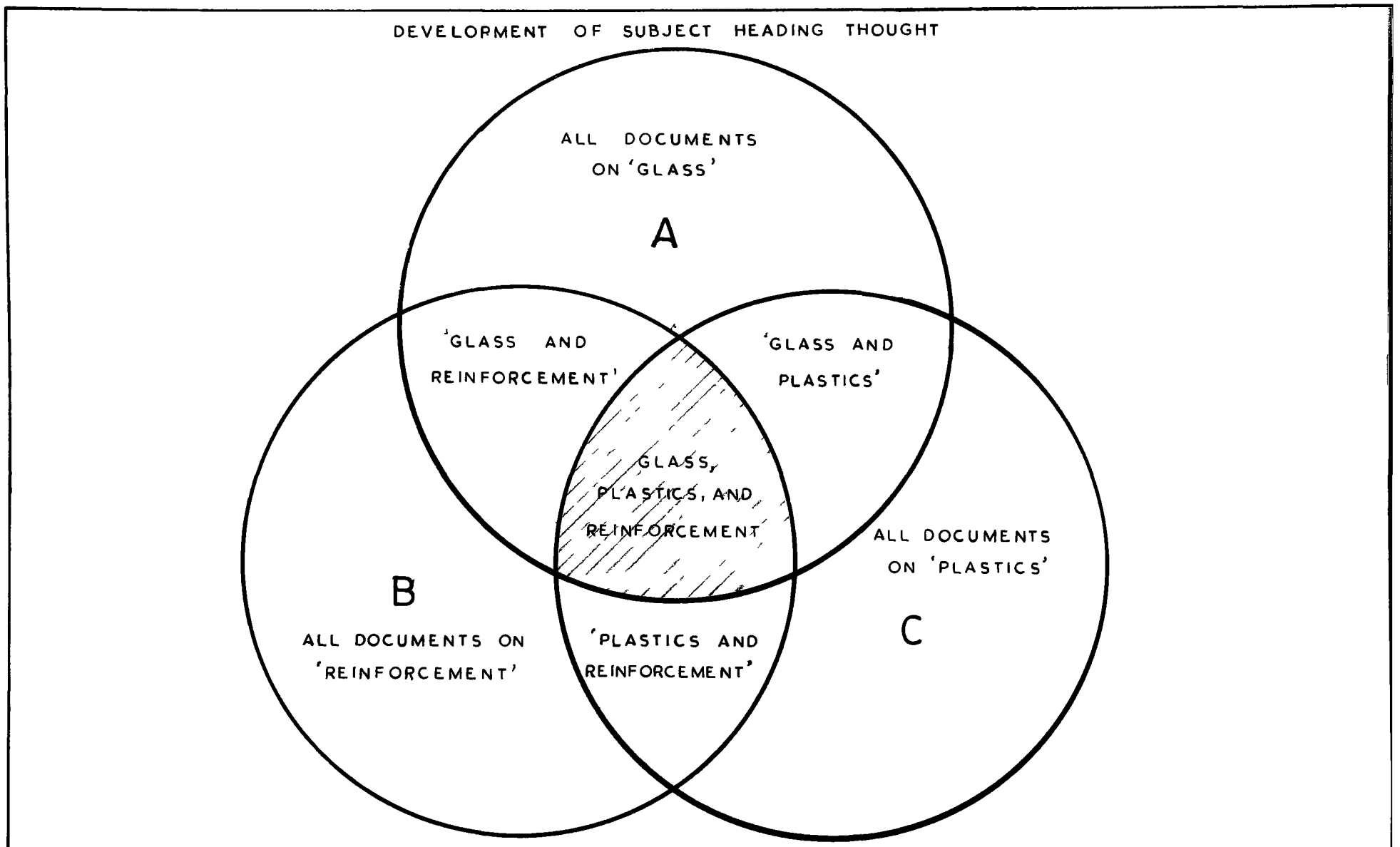


FIG. 4: INTERSECTION OF THREE UNITERM CARDS ON 'GLASS', 'PLASTICS' AND 'REINFORCEMENT'

file of uniterm cards having document accession numbers in one of the ten columns according to the terminal digit. Unit of record is not the document, but the uniterm. In conventional indexing system, the unit of record is document. Thus the size of searching file is equal to the size of vocabulary due to the inverted arrangement of terms and documents. This is a significant feature of Uniterm Indexing. Retrieval is sought by performing logical operations of product, sum, and complement, progressively narrowing the field to be searched. For example, for the material on "Glass fibre reinforced plastics", the numbers (of documents) on "Glass" and "Plastics" cards are matched. The matching numbers will be then compared with the document numbers on "Reinforcement" card. The numbers tallying in this comparison indicate the documents relevant to the topic "Glass fibre reinforced plastics". The Figure 4 on the opposite page explains the logical operation of coordinate indexing. The circles A, B and C represent the uniterm cards "Glass", "Plastics", and "Reinforcement". The shaded area is the intersection of circles A, B and C, representing the retrieved documents on "Glass fibre reinforced plastics". This system has been found to be practicable and useful. C. D. Gull[31] reported that in 98 test information searches, coordinate indexing carried 77.1

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31 C. D. Gull, "Seven Years of Work on the Organisation of Material in the Special Library", in American Documentation, Vol.7, issue of October 1956, p.320-329.

percent and conventional alphabetical subject catalogue 64.6 percent. Quick retrieval and deep subject analysis are the definite advantages of Uniterm Indexing. In the U.S. Patent Office, where Uniterm Indexing was in use, a patent could be indexed by as many as 450 concepts[32]. The "Geodex", a current-awareness subject indexing service in Earth Sciences, uses the method of Uniterm Indexing. Originally the Uniterm Indexing was devised for manual or visual comparison of document numbers on cards. Now it is accomplished on computers at high speed. Practically the Uniterm Indexing System of Taube is a mechanical selector technique without the mechanism.

Taube's Uniterm Indexing is comparable to "Aspect Cards", or "Peek-a-boo cards" developed by W. E. Batten of Imperial Chemical Industries in England in 1939. The difference between the two lies in storage media. Batten's system depends upon dedicated punchable spaces in card-field, but Taube's does not; hence, the latter has no problem of exhaustion of space.

But the Uniterm Indexing has its own problems. A uniterm index does not provide generic survey, facilitated by downward and upward cross references, called syndetic references in a conventional subject catalogue. It is also inefficient in discriminating various view points and aspects.

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32 J. C. Costello, Op. Cit.

For example, Oil is used in paint, polish, fuel, perfume bases etc. Unless adequate vocabulary control is developed, the system cannot prevent false coordination of "Oil" for various aspects, such as "Oil as additives", "Oil as perfume base" etc. There is also the problem of correlation of terms. When a document is indexed under multiple uniterms, relationship of each term to the other (for the purposes of specificity) remains undefined. There is every likelihood of false coordination or retrieval of non-pertinent documents. As a solution, "tagging" of terms with "role indicators" and "relationship links", or "syntactic connectives" as Taube calls them, is proposed.[33] If the system has terms only for "Lead" and "Coating" and there are two documents in the collection, namely, "Lead as a Coating" and "Coatings for lead", coordination will be false, unless the terms are increased by tagging role-indicators, such as "Lead", "Lead as a product", and "Lead as a raw material". These can also be distinguished by adding some symbol following the basic term, such as "Lead", "Lead I" and "Lead II". The Roman numbers stand for roles. To borrow another example from Taube, a document on "Lead coatings for copper pipes" will be indexed under "Lead", "coating", "Copper" and "Pipes". This document will be retrieved against a search for "Lead Pipes" also which is a false coordination;

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33 M. Taube, "Notes on the Use of Roles and Links in Coordinate Indexing", in American Documentation, Vol.12, issue of April 1961, p. 98-100.

hence, the need for adding links as shown below :

| Lead | Coating | Copper | Pipes |
|---|---|---|---|
| 100 AC | 100 AC | 100 BC | 100 BC |

In the above postings, 100 is the document number and C indicates that both 'Lead' and 'Coating' are connected with 'Copper pipes'. If the operation of the system is manual, such posting of numbers or symbols to synonyms, view-point terms, difference terms and terms of generically higher level is really a problem.

C. N. Mooers' Zatocoding[34] is also a system of coordinate indexing by superimposed coding through random numbers. In his system, each descriptor represents a concept in a "Dictionary of Notions". Each document is examined against the complete list of descriptors incorporated in the system, retaining those which characterize the document. This is called "Filtering Technique". It is further simplified by the use of a list which regroups the descriptors under a series of "Chapter Headings" presented in the form of questions.

b) Thesaurus approach. - Thesauri have been developed in broad subject-fields as tools both for indexing and for retrieval of information. Engineering Joint Council, Newyork[35] has developed

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34 C. N. Mooers, "Choice and Coding in Information Retrieval Systems", in the Institute of Radio Engineers, Symposium on Information Theory, Sept.15-17, 1954 : Transactions of the Professional Group on Information Theory, No.4, n.d., p.112.

a thesaurus for Engineering and Scientific Terms. The thesaurus approach emerged as a solution to various factors of ambiguity in vocabulary. It serves as a source of authoritative vocabulary required for automation of information storage and retrieval. The first suggestion for use of thesaurus for this purpose came from H. P. Luhn[36] in 1957. He suggested a thesaurus comprising a "Dictionary of Notions" and "Notional Families"; the former being an alphabetical index of the text-words occuring in the notional families, and the latter giving the key-words of one or several Notional Families of which the given text word is a member. For example :

| Notion Number | Notional Family |
|---|---|
| C0 | artery, blood, heart |
| 036 | lowering, reduce |
| 17 | action, work, stimulate |
| 37 | female, feminizing, woman |
| 46 | experiment, measure, study |

For mechanical indexing, a machine would scan a text word by word and whenever, say artery, blood, or heart occured, it would consult its thesaurus and record the notion C0. Thus

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35 Engineering Joint Council, Thesaurus of Engineering Terms, 2d ed., New York, The Council, 1967.

36 B. C. Vickery, "Thesaurus - a New Word in Documentation", in Journal of Documentation, Vol.16, issue of December 1960, p.181-189.

passage from textword to key-word is mechanized.

The recent thesauri are closely similar to Roget's famous work "Thesaurus of English Words and Phrases"., published in 1852. Roget's thesaurus helps a writer to pass from idea-words to text-words and in an information system, a thesaurus aids an indexer or enquirer to pass from text-words to key-words. As opposed to coordinate indexing, thesaurus provides for cross-references. Eugene Wall[37] proposed that thesaurus should list indexing terms alphabetically and indicate the references of the following types against each indexing term :

1. From Synonyms, Brookes, See Rivers
2. Generic links, Sabine River Post on Rivers
3. Specific links, Rivers Generic to Sabine River
4. Relational reference, Safety related to Accidents, Burns, Injuries, etc.

A thesaurus is useful for choice of single concept terms, control of vocabulary, display of relations, and thus a good complement to coordinate indexing but offers no solution to word-order in a multiple subject heading in a subject index operated manually.

C. J. Frarey[38] reported that Welch Medical Library Indexing Project of John Hopkins University has developed a new

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37 B. C. Vickery, Op. Cit.

38 C. J. Frarey, Subject Headings, New Brunswick, N.J., Rutgers University Press, 1960, p. 20-21.

technique called "Category Analysis", aiming at maximum consistency in terminology form and heading structure and an integrated and effective cross-reference network. All subject headings are sorted into a limited number of concept groupings coded according to category assignment and other relevant characteristics and recorded on punched cards to facilitate sorting by groups and characteristics. This method is used in preparing the subject heading list for the "Current List of Medical Literature", published by the National Library of Medicine, U.S.A.

c) Mechanization. - Mechanization aims at providing mechanical or electronic facilities to permit the existing activities to function in a more economical and efficient manner. It does not abolish the intellectual part of the work, but brings about changes in clerical and physical routines. However, any element of human thought is excluded in mechanized routines, as it spoils their mathematical exactness. A mechanized system responds quickly and can process large quantities of information. But, mechanization is not a rule of thumb. It requires detailed feasibility studies.

Mechanical selection, such as that of Samain[39] is a mechanization of indexing. It is based on random coding of indexing terms, with a view to avoid the complexities of the display of subject relationships. All the numbers used for encoding the terms which characterize a document are recorded on a card which refers

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39 B. C. Vickery, Op. Cit.

to that document. The machine then sorts out from a pack all such cards which have a code number or a combination of more than one such numbers which the selector chooses. But J. W. Perry criticized : "[...]direct coding of index words is an extremely naive approach and is quite limited in effectiveness"[40].

Among the simple applications of mechanization in subject access field, one is the "Permutable Indexing" developed by Herbert Ohlman at the Systems Development Corporation. The concept is not new. It is an adoptation of key-word index for machine use and suffers with most, if not all, of the shortcomings which a key-word index or concordance does. It is a wasteful extravagence of subject indexing potential of an information retrieval system.

In computer print-outs, string of every title is permuted at each significant word in the title, displaying each time one significant word but in its context only; hence, one such index was named by H. P. Luhn at the IBM as KWIC (key-work-in-context) Index. The semi-monthly index to Biological Abstracts, called "BASIC" (Biological Abstracts Subjects In Context), is a permutable index. Also the manual use of KWIC concept is possible, but for small libraries only. The KWIC approach was later improved by increasing the length of title string from 80 to 120 characters and also by introducing the concept of

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40 Op. Cit.

"enrichment" - putting a slash after the title and adding such terms from the document which explain the information content of the document. The NASA (National Aeronautic and Space Administration) uses the enriched KWIC index method. Of late, KWOT (Key-word out of Title) indexing method has been developed. The principle is same, but procedure is different. In a computer programme for KWIC index, terms to be omitted are listed up; whereas, in KWOT index method, important terms are listed up. KWOT approach is more selective. The Diabetes Literature Index uses the KWOT method.

# CHAPTER V

## THE SEMANTIC PROBLEMS

A natural language is often ambiguous and subjective, as apposed to an artificial language which is pure and objective. Therefore the systems using a natural language face semantic problems. In simple terms, Semantics means dealing with the meaning of words. In order to make expression of subject intelligible, a theory of the semantics of subject headings is needed. There are two aspects of the semantics; one, determination of specific subject of document, and two, its expression in the form of a subject heading. This can be categorized in terms of Information Science as "contents analysis", "facts identification", "levelling" and "translation into data elements". To correlate these terms with the terminology of the conventional subject indexing, contents analysis is heuristics, i.e., discovering the information content of the document; facts identification is formulation of subject statement or identification of significant subject traces; levelling is specificity; and translation into data elements is choice of terms.

1) Heuristics. - The first aspect, i.e., determination of specific subject of document was not taken due care of, even after Hans Trebst introduced the concept of heuristics of subject headings. It was left to the flair and personality - traits of indexers. A systematic approach to this problem came forth from P. C. Coetzee when he renewed emphasis on heuristics while

presenting his formulary for subject headings and from S. R. Ranganathan when he made it a part and parcel of his "Facet analysis" for subject headings.

For creating a cognitive map of the information contents of a document raw material is collected from title, table of contents, introduction, index and text of the document and a statement of subject is formulated which has as its components, the type of communication (whether normative or derivative) literary form, (a monograph or an encyclopaedic article), the theme and its milieu and connection of the document with other branches of knowledge.

Then comes the question of communicating to the user correctly and intelligibly what has been discovered by the indexer about the specific subject of the document. Depending upon the policy of the library or the indexing system, the level of subject representation is then decided - how deep the document should be indexed. This is a vital point. Based on this, subject statement is translated into data elements which are the information carrying words enering into the storage of the system.

2) Classification and the semantics of subject headings. - The classification and the subject headings both deal with analysis of information-content of documents. Classification is a hierarchical mapping of subject relations; whereas subject headings use the letters of alphabets as classes. For display of

subject relationship, a subject index uses syndetic references- upward references from specific to general; downward references from general to specific; and collateral references to the terms on the same level of classification (array). This similarity of cross-references to classification was named by Bradford[1] as "concealed classification". Logical classes are created in a subject index through the use of inversion and subdivision methods also. This made G. Scheerer to remark:

> Every subject heading list presupposes a basis in classification either through category analysis or through reference to a real or ideal classification, because this is the way we organize and classify our knowledge.[2]

If a sound classification theory is not made use of in selecting and coordinating the subject heading terms, it makes the conventional alphabetical subject index inconsistant and irregular.

This living together of classification and dictionary catalogue is called "Symbiosis". It was extended by S. R. Ranganathan to cover the duality which exists in classification schemes. A supplementary alphabetical index is provided along with the logical schedules of subjects.

3) Choice of terms. - In the existing practice of subject headings based on usage, choice of terms is arbitrary, inconsistent and confusing for the cataloguer to apply and for the user to follow. Drawing an analogy between usage and a language

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1 S. C. Bradford, Documentation, 2d ed., London, Crosby Lockwood, 1953, p. 58-59.

2 G. Scheerer, "A Subject Catalogue Examined", in Library Quarterly, Vol.27, issue of July 1957, p. 192.

dictionary, A. Khurshid and his associates wrote :

> Any generally repeated mispronunciation or semantic distortion, no matter how illogical or coincidental will soon be incorporated into the dictionary. Similarly, the cozy logic of subject cataloguing theory is periodically rearranged by public ignorance or misuse.[3]

Principle of usage often comes into conflict with the principle of specificity. As a result, grouping of subjects is shot to pieces and related material gets scattered.

This situation can be attributed to adoption of the principle of usage without any restrictions. If a policy is made to follow the usage of the class of users for whom the material is intended, choice of terms will remain consistent to a large extent. It would be a safe practice, if such terms are chosen which would adequately identify the concept to well-informed users. Others may be led to the selected terms by means of cross-reference.

a) Linguistics of subject headings. - Failure to recognise the complexities of language results in loss of efficiency of the communication process itself. The concepts and the language used to communicate the concepts interact in the process of ideation. Bernier has rightly remarked : "Words are windows through which subjects are seen"[4].

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3 A. Khurshid, et al., "Philosophy of Subject Cataloguing", in Pakistan Library Review, Vol.3, issue of Sept.-Dec. 1961, p.41.

4 C. L. Bernier, "Subject-Index Production", in Library Trends, Vol.16, issue of January 1968, p.389.

In subject indexing, one is closely concerned with adequate subject representation of documents. The range of representation extends over key-words, phrases, set of sentences (as in abstracts), and full texts (as in microforms) and the system development is directly related to systems capacity to sustain this range of representation. This aspect of subject heading work was named by Thyllis M. Williams as "language engineering"[5]. The term was earlier used by George A. Miller[6].

Subject headings in their capacity of being a point of reference form a technical language and have to have a unique ordial value. To satisfy this, each heading or subheading has to be a noun. Thus, subject headings are chiefly a language of nouns.

Terms are to be chosen preferably from the active vocabulary of the users, i.e., terms they use habitually and confidently. Alternatively, the choice must be from the passive vocabulary of the users, i.e., the expressions, of which they are able to recognize meaning more or less precisely but which they would not readily use in communication. Bernier[7] has emphasised also on durability of vocabulary as a desirable property. The measure of durability is the length of stable semantic history of terms. Still the terms undergo semantic changes;

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5 T. M. Williams, "Language Engineering", in J.H.Shera, Documentation in Action, New York, Reinhold, 1956, p.330-337.

6 George A. Miller, "Language Engineering", in Journal of Acoustical Society of America, Vol.22, issue of November 1950, p.720-725.

7 C. L. Bernier, "Language and Indexes", in J.H.Shera, Op. Cit., p.329-329.

hence, the need for modernizing the terminology and developing a mechanism for awareness of semantic changes through periodical literature of specific subject fields. But it is impossible to stretch a cataloguer's awareness to the extent that he covers all the fields of knowledge. He has to depend upon specialists in the field, say on faculty in a College or University library. . As the last resort, when it is not economical to change the entries, obsolete headings may be retained.

Structure of a particular language also has significance to the ease and efficiency of the form and structure of subject headings. As Denise Montel concluded, English is peculiarly suited for the formulation of subject headings. The attempts to translate the English lists of subject headings into other languages did not prove fruitful.

> English is a language of nouns, French of verbs; and this difference lends English a suppleness and fluidity French, for all its precision, lacks. English naturally lends itself to phrase grouping. In French the equivalent must too often be put into a full blown sentence. Any English noun, moreover, is at will convertible into an adjective (house wrecker, crime detection, mystory story); to express the same idea in French one must resort to round-about locations .[8]

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8 Denise Montel, "France Adopts American Subject Headings", in Library Journal, Vol.63, 1940, p. 1014-1017, quoted by P. C. Coetzee, Op.Cit., No.23, 1957, p. 19.

b) Specificity. - It is fundamental to the very purpose of subject headings. Cutter's Rule 161 prescribes: "Enter a work under its subject heading, not under the heading which includes the subject [. . .]"[9] But, as interpreted by E.J. Coates, Cutter envisaged a set of stock (established) terms under one of which each subject is to be accommodated. If the subject of the book is more restricted in scope, the book must be placed under the most nearest stock term which contains its subject, "just as the purchaser of ready - made clothing buys the nearest larger stock size to his actual size".[10] In this context, Cutter's concept of specificity is primitive.

Prevost recommended as a general rule: "Be specific, but via the subhead not the adjective".[11] Her suggestion involves rather the form of a heading. At the same time, she cautions the indexer against the use of adjectives; to use 'Libraries - National', but not 'National Libraries'. In this recommendation, subdivision is no more different than inversion 'Libraries, National'. Prevosts support of subdivision for the purposes of specificity runs the risk not only of losing the potency of specificity of entry element, if an indexer chooses to use sub-subhead, but also of introducing class headings by allowing intermediatary subheads.

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9 C.A. Cutter, Rules for a Dictionary Catalog, 4th ed., Washington, G.P.O., 1904.

10 E. J. Coates, Subject Catalogues: Headings and Structure, London, Library Association, 1960, p. 33.

11 M. L. Prevost, "An Approach to Theory and Method in General Subject Headings", in Library Quarterly, Vol. 16, 1946, p. 149.

Over and above these problems, specification of subjects has been often confused with specification of documents in the process of detailed codification of subject - matter and the form. Such complexities led Metcalfe[12] to warn indexers if they went too far in specifying each book by its unique topic and form, they might get into such a tangle of arrangement and sub-arrangement that it may defeat the very purpose of indexing. Metcalfes advice is only an escape from the problems, not a solution.

As a plain formula of specificity, Haykin[13] recommended that a subject heading should be as specific as the topic it is intended to cover. If the most specific heading is not used, it is not possible to set a standard for its scope. The purpose of specificity is that user must get to what he wants by a name of his subject which he knows without any guess-work classification on his part. For example, he need not guess that indexer might have entered 'Chairs' under 'Home economics', 'Furniture', or 'Chairs'. He must be sure where to look.

C. J. Frarey[14] defined specificity of a subject heading as a property secured both by choice of terms and by form and structure of heading. These two are internal factors. There are

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12 J. W. Metcalfe, Subject Classifying and Indexing of Libraries and Literature, New York, Scarecrow, 1959.

13 D. J. Haykin, Subject Headings: A Practical Guide, Washington, G.P.O., 1951.

14 C. J. Frarey, Subject Headings, New Brunswick, N.J., Rutgers University Press, 1960, p. 35.

external factors also. In logical connotation, specificity is concrete but in the context of the functions a subject heading has to perform, it is relative. It is subject to limitations inherent in language, amount of literature in that particular subject field, size of collection, size of catalogue, nature of demand (specialist or generalist) and personal experience of indexer.

c) Qualification. - There has been confusion over distinguishing the specification and qualification of a subject also. Specificity does not allow subordination of a species to a genus in the structure of a subject heading. But a qualification is subordinated to a concept whether heading - subheading form is used or not; for example 'Chairs', not 'Furniture - Chairs' in case of specification of subject 'Chairs' and 'Swimming Accidents' in case of qualification of subject 'Swimming'. Qualification often names an aspect or process of a main concept but the qualifying property of the term is relative to its function in the subject heading. In 'Swimming accidents', 'Swimming' can also be taken as a specification of 'Accidents'. When specifying, the terms stand in genus - species relationship but are not subordinated in the structure of a heading. J. Kaiser was clear on this point through his "Concrete - Process" concept. Many qualifying terms are recurrent in nature; hence, represented in a classification by mnemonic form divisions. Many a time, qualification is placed in parenthesis; mostly for defining the terms

in case of homonyms. For example:

'Style, Literary' 'Style (Practical Printing)'

Such auxiliary terms are called role indicators in coordinate indexing and indicated by symbols, not by grammatical categories.

The qualifying auxiliary words placed in curves sometimes have ordinal value, such as 'Milk (in religion, folklore, etc)', and at other times they do not, that is, they are ignored in filing; for example, 'History, classification' and 'History, (of) classification'.

d) Subject vs. place. - The problem of the entry element for a subject restricted to a particular locality has engaged the attention of subject heading theorists. Cutter's Rule 165 recommended:" A work treating of a general subject with special reference to a place is to be entered under the place, with merely a reference from subject."[15] He even went to the extent of providing double entry, entry under place as well as under subject.[16] Knapp has pointed out to a particular attitude of users. They tend to look under the name of the subject for materials relating to their own community and their own country, but look under place for subjects which have a non-local or foreign geographic focus. Margaret Mann[17] recommended entry under subject with sub-division

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15 Op. Cit.

16 Patricia B. Knapp, "The Subject Catalogue in the College Library: An Investigation into Terminology", in Library Quarterly, Vol. 14, issue of July 1944, p. 214 - 228.

17 Margaret Mann, Introduction to Cataloguing and Classification of Books, 2d ed., Chicago, ALA, 1943.

for the place name, except when the subjects were those closely relating to a people, state, or place. Further elaborating the point, she prescribed indirect subdivision by using country or state name before local name when the subject treated was biased towards a country or state. In case a smaller region or locality is the focus, direct subdivision using the place name may be used.

To sum up, the problem is treated on 'Significance rule'. Normally entry is preferred under the subject, except when subject treatment has local characteristics in which case entry is made under the place name. It is more so in broad subject-fields rather than in minute ones; for example, 'Canada - Agriculture', not 'Canada - Pest Control'. Certain subject-fields, closely relating to a people or place, lend themselves to entry under place name, such as, Geography, History, Language and Literature and certain others bear predominant subject-interest, such as Science, Technology, Philosophy and Religion.

The 'Subject-versus-Locality' problem in fact belongs in the realm of heuristics and of subject analysis in its abstract form before it is tied up to any type of subject representation. It is not the question of discretion of an indexer either to choose from among the alternatives of 'Subject' and 'Place', or to provide entry under both. The 'significance rule' carries and indexer is bound to abide by and represent the treatment the subject is given.

# CHAPTER VI

## THE SYNTACTIC PROBLEMS

Semantic studies alone do not provide solutions to all subject heading problems. We have to take cognizance of the syntactic[1] problems also. In simple words, the syntactical problems are the problems of work-order in a multiple subject heading. For example, in the phrase "National Library for the blind", the words "National", "Library", "blind" stand in a definite relation to each other which is termed as syntactical relation.

1) User - relevance of the syntactics. - Usage has been for long a guiding principle for word-order in a multiple subject heading. In this capacity, usage was a measure of user-relevance of the word-order. But this was not a disciplined course of formulation of subject headings. Need for systematization was felt as long back as J. C. Schwartz and continued in the shape of refinements which followed and is still undergoing significant changes for the better. All through, the user's position as the chief beneficiary of subject index has exerted a check on the trends of making the word-order too logical or too mechanical.

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1 The term "Syntactics" was first used by Charles Morris in his Signs, Language and Behavior, New York, G. Braziller, 1955, p. 249.

To certain extent, systematic word-order provides efficiency in consultation. The user is sure as what to look under. The entry element is almost always predictable to him. But too much of logic in word-order confuses the user. He cannot be expected to master complicated rules.

2) System - relevance. - On the other hand, word-order cannot be based mere on the expediency approach. Subject heading problems of today are too diversified to be solved by simple advices like the one given by M. L. Prevost: "Be specific, but via the subhead not the adjective". Subject headings need to be systematized and systematization is basic to all development; hence the need for a theory of the syntactics of subject headings.

Semantically, a subject heading as a whole points to a particular referent and, syntatically, it has a fitting place in the subject index which is an ordered totality of points of reference. If the word-order in a heading is imperfect, it has double effect; as an individual entry it may lose the property of pointing to that particular referent and may also lose its proper place in the existing structure of subject index. Thus the search may not retrieve that heading; even if retrieved, the heading may fail in pointing to the required referent. For example, if the components of the phrase "National Library for the blind" are re-arranged as "Library for the national blind", not only the connotation of the phrase is changed but, supposing it is filed in a large catalogue, it would be lost to a searcher who expects that the phrase would run as quoted first.

3) Factors influencing the syntax of subject headings. - It must be noted that there is no intrinsic value of the terms used in subject headings. It is related to the function a subject heading is to perform through term - significance and term-relationship.

a) Term - significance. - The concept of term - significance is as old as the subject heading practice itself. From the old key-word indexes of Germany to the modern descriptor-based computerised subject indexes, significance of terms has been the central point in all the subject indexing systems. E. J. Coates defined significance as: "the most significant term in a compound subject heading is the one which is most readily available to the memory of the enquirer".[2]

Perhaps he meant the most significant term attracts the attention of the enquirer first. If this assumption is not conceded, the definition of term-significance will be defective. Availability of terms to the memory of the enquirer is not the direct effect of term-significance only. An enquirer may not even know a term which is indicative of the subject of his interest. He may start his search with a generic term of wide coverage. So, in this case, the generic term is not a significant term for indexing that document. The above definition can be modified as: the most

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2 E. J. Coates, "Subject Catalogues: Headings and Structure, London, Library Association, 1960, p. 50.

THE SYNTACTIC PROBLEMS

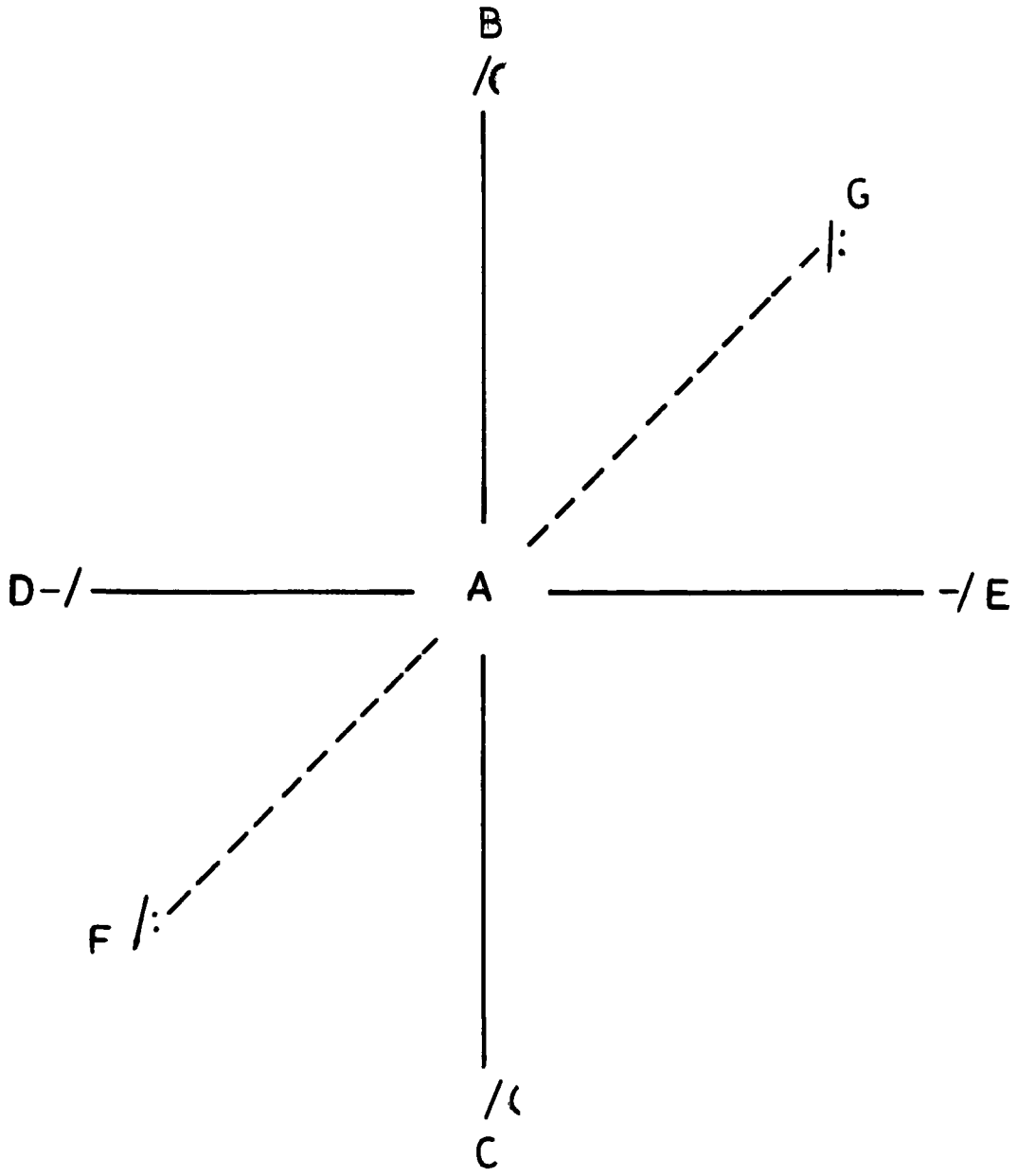


FIG. 5 : THE THREE-DIMENSIONAL EFFECT OF USING THE THREE TYPES OF 'OPERATORS'

significant term in a compound subject heading is the one which is most vital to subject representation of the document. Such a significant term may have the highest potency as a point of reference.

b) Term - relationship. - Rendering of a subject heading in a natural language which constitutes the notation for alphabetical subject indexing gives rise to the problem of term-relationship in the heading. In a natural language such relationships are expressed by verbs and prepositions; if not apparent, they are implied.

This aspect of subject heading work faces two problems: levels of relation and levels of expression. Relations between the terms are not always simple and linear; for example, A relates to B, B relates to C, C relates to D, etc. Genus - species relations are of this nature. There are complex or multi-directional relations also; B contains A and A contains C (B /( A /C C) in one direction; F causes A and A cuases G (F /: A /: G) in another direction, and D reacts to A and A reacts to E (D -/ A -/ E). The three-dimensional relations of this type have been shown in figure 5 on the opposite page.[3]

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3 J. E. L. Farradane, "A Scientific Theory of Classification and Indexing", in Journal of Documentation, Vol. 6, 1950, p. 83-99 and Vol. 8, 1952, p. 73-92.

Alphabetical subject indexing has to take cognisance not only of the levels of relation but also has to provide mechanism for a compatible level of expression. But in practice the matters are quite reverse. Level of relation to be expressed in a subject heading is determined by the level of expression available to the indexing system. Thus, problems of notation have over-shadowed the far more important problems of relations.

Syntactical devices like inversion, subdivision, and cross-references are used to express term - significance and term - relationship in a subject heading.

i) Inversion. - The concept of inversion has arisen from the concept of term - significance. Cutter recommends that a compound subject name may be entered by its first word, inverting only when some other word is decidedly more significant or is more often used alone with the same meaning as the whole name. In principle, he ruled out inversion, because it brings in the class entry. J. Kaiser also did not favour inversion, but for a different reason that users' interest was not predictable; for example, 'Copper coins'. Some users might be interested in uses of copper, while others might look for varieties of coins. Often interest is mainly in genus expressed by noun and not in the differences expressed by adjectives. J. W. Metcalfe[4] views

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4 J. W. Metcalfe, Information Indexing and Subject Cataloguing, New York, Scarecrow, 1957.

the problem from another angle and recommends that inversion should be used in general libraries. In special libraries, depending upon the subject field of the speciality, inversion of subject name may not be necessary. For example, in a furniture library, inversion of 'Steel furniture' may be undesirable. B. C. Vickery[5] supported direct rather than inverted use of phrases, but advised that prepositional phrases should be kept to a minimum.

Though inversion of subject headings represents the established English usage in inventories and appears to be sound in case of adjectival and prepositional phrases of two or three components, but is no solution to multiple - facet subjects of narrow specializations in modern science and technology. For example, inversion of 'Educational psychology' as 'Psychology, Educational' is simple both to indexer and user, but inversion of 'Permanent flame-proof finishing of cotton fabrics by use of phosphorus' is obviously difficult to be converted. Inversion is like subdivision though not in form and has no semantic justification. It is an incomplete designation of a referent. An inverted heading is an expression which needs to be considered as a whole before its relation to a referent can be grasped; for example, 'Camera, Engineering uses of'. In this heading, the inverted element 'Camera' is an incomplete designation of the connotation which it carries in the heading, together with the confusing filing practices, it causes alphabetical chaos which makes consulting of subject index cumbersome.

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5 B. C. Vickery. Classification and Indexing in Science.

ii) Subdivision. - Due to limitations of notation, the subdivisions are never fully logical and the results have been little more than "standardized systems of pigeon - holding". Use of subdivisions is against the basic principles of direct entry and usage. In introducing class headings into an alphabetical subject index, use of subdivisions is more rigorous than inversion of subject headings. This similarity with classification is by chance, though not by design. The main purpose of using subdivisions is to reduce file length under a given subject and thus help the subject headings in serving as efficient points of reference. In doing so, the subdivision device curbs the direct self-indexing property of the terms used as subheadings. Prevost[6] has used a heading like "Libraries - cataloging". But, 'Cataloguing' is a term which is fit to be used as heading in its own right. This shortcoming of subject heading practice has developed due to the indexers' attempt to"be specific via. subead." This is in fact a confusion over subdivision and specificity. Various types of subdivision, such as, subdivisions by aspect, form, period of time and geographical area are used. Whatever types of subdivision are used and to whatever degree subdivision is allowed, the specificity achieved is different from the specificity achieved through coordinate indexing. Due to linguistic limitations, specificity is not concentrated in the

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6 M. L. Prevost, "An Approach-to-Theory and Method in General Subject Heading", in Library Quarterly, Vol. 16, 1946, p. 148.

entry element but overflows to other elements in the heading. Subdivision is only a device to arrest such overflow. But there must be a check on the use of subdivision device so that the heading does not become an alphabetico - classed heading. This made Haykin to recommend that subdivision should be restricted, to the form in which the subject matter is presented.[7] Inefficiency of subdivision as a syntactical device is evidenced by the Library of Congress practice. C. J. Frarey[8] has reported two studies on the inconsistent use of subdivisions by the Library of Congress: 1) J. E. Allerding, "Form Subdivisions for Bibliographical Publications", in Journal of Cataloging and Classification, Vol.1, issue of October 1942, p. 219-223, and 2) H. W. Batchelor, The General Form Divisions of Library of Congress Subject Headings, unpublished M.S. essay presented to the University of Illinois, 1937.

iii) Cross-references. - The cross-references are used in alphabetical subject indexing as an auxiliary device to lead user from different forms of expression of a subject to the one actually used. They serve as a finding aid particularly to less knowledgeable users and also display subject relations, to facilitate generic survey of the subject. Mostecky reported that subject headings alone yielded only 40 per cent of the material available in the

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7 D. J. Haykin, Subject Headings: A Practical Guide, Washington, G.P.O., 1951.

8 C. J. Frarey, Subject headings, New Brunswick, N.J., Rutgers University Press, 1960, p. 35.

collection. Use of 'See also' references increased this yield to 60 per cent.[9]

Cutter named this part of a subject catalogue "the syndetic apparatus". "They are the guide posts that show which road the reader is on and where he will get to whatever way he turns."[10] The extent to which these connective references are used is relative to the purpose of the library/index, size of collection/literature, rate of growth of catalogue/index, nature of libray's clientele and attitude of the users. Three types of cross-references are used: 1) 'See' references, 2) 'See also' references, and 3) General references. 'See' references, 2) ~~'See also'~~ are made from synonyms, variant spellings, second part of a compound heading and an inverted heading, and from subject headings to class number in shelf-list. 'See also' references comprise three levels of indication: 1) 'upward references', from specific to broader subjects ('Roads, construction' See also 'Civil engineering'); 2) 'downward references', from broad subjects to specific and subordinate subjects (Civil engineering See also 'Piles, Driving', 'Bridges', etc.); and 3) 'lateral references', from specific subjects to coordinate subjects ('Roads, Construction See also permanent way engineering').

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9 ~~R. I. Ka~~ Vaclav Mostecky, "Study of the See-also Reference-Strueture in-Relation to the Subject of International Law", in American Documentation, Vol. 7, issue of Oct. 1956, p. 294-314.

~~10~~ Margaret Mann, Introduction to Cataloguing and Classification of Books, 2d ed. Chicago, ALA, 1943, p. 139.

'General references' are used to indicate all headings of a particular kind. This becomes necessary when special treatment of subjects is to be brought to the notice of the users. Normally, general references are made for subject, form and geographic subdivisions.

In spite of the important role the cross-references play in an alphabetical subject index, they need to be kept at the minimum. Users like much to have the heading they seek rather than a reference to it. Not only in quantity, but also in quality they must be based on economy in compiling and more so in using the index. The upward references "have the effect of sending the reader on a wild goose chase" and render the catalogue "cluttered up with a plethora of references."[11] For the sake of convenience in compiling, multiple cross-references are recommended in 'Chain Procedure' of S. R. Ranganathan and 'Rotated Entry' method of C. L. Bernier.[12] For example, in 'Chain Procedure', the heading 'Spectra. Atoms. Helium. Fine structure' gets the following cross-references:

Atoms, See also Spectra

Helium, See also Spectra. Atoms

Fine structure, See also Spectra. Atoms. Helium

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11 D. J. Haykin, "Subject Headings: Principles and Development", in M. F. Tauber, Subject Analysis of Library Materials, New York, ALA, 1957, p. 43-54.

12 B. C. Vickery, Op. Cit.

In 'Rotated Entry' method, the same heading gets the following additional entries in place of 'See also' references:

Atoms. Helium. Fine structure. Spectra
Helium. Fine structure. Spectra. Atoms
Fine structure. Spectra. Atoms. Helium

A systematic approach needs to be employed in making cross-references. Adoption of a fully worked out scheme of subject relationships such as found in a classification scheme in making such references can result in a more rational and functional structure. Even mechanization of cross-references has now been achieved. Since 1964, the monthly issues of Biological Abstracts[13], Philadelphia, contain CROSS (Computer Rearrangement of Subject Specialities) Index. It is a machine handled cross-referencing system.

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13 R. T. Bottle, Editor, The Use of Chemical Literature, 2d ed., London, Butterworth, 1969, p. 60.

# CHAPTER VII

## STANDARDIZATION OF SUBJECT HEADINGS

1) The so-called codes. - There have been sets of rules and codes of practice for subject headings. Before Cutter, there was no code for a dictionary catalogue as a whole. The 91 rules developed by Sir Anthony Panizzi, to which all the subsequent codes are indebted, were chiefly concerned with the author-title catalogue. Cutter published his Rules for a Dictionary Catalog in 1876. Later, in the 4th edition, the rules were enlarged to include the needs of a card catalogue. For all practical purposes, this has been the only significant code for subject heading work. Until the English translation of the 2nd edition of the Vatican Norme[1] was published in 1948, the best code was available only in Italian language. Against many mini-codes of subject heading work attempted in almost all the standard texts on cataloguing, those given by J. W. Metcalfe, viz., the 'Tentative Code', D. J. Haykins, P. C. Coetzee, S. R. Ranganathan, Mortimer Taube were significant.

2) The standard subject heading lists. - As a source of standardized subject headings, the enumerative lists of subject headings also have been in use. There are two types of such enumerative lists: 1) general lists and 2) special lists. Among the

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1 Vatican Library, Rules for the Catalog of Printed Books, translated from the 2d Italian ed. by T. J. Shanahan, et al., ed.by W. E. Wright, quoted by J. Lee Harris, Subject Analysis : Computer Implications of Rigorous Definition, Metuchen, N. J., Scarecrow, 1970, p.4

general subject heading lists, the List of Headings Related to the Revised Edition of Poole's Index to Periodical Literature, published in 1878, was the pioneer list. It carried out the principles laid down by Cutter. Then came the A.L.A. list of Subject Headings for Use in Dictionary Catalogs, published in 1895. This also was based on Cutter's rules and was designed for use by small libraries. It established a pattern for the subsequent subject heading lists like that of Library of Congress and of Sears. The Library of Congress list: Subject Headings Used in the Dictionary Catalogs of the Library of Congress was first published in parts from 1909-14. Now the 7th edition is in use which is supplemented periodically. The LC (Library of Congress) subject heading practice is a great example of expediency approach. It attempts at bringing about a compromise between various approaches, particularly those of a dictionary and alphabetico-classed catalogue, by such means as inversion, combination of terms and subordination of subjects to each other. But many of its subject heading patterns are outdated, inconsistent, incomplete and, at times, unnecessary. "Whilst being valuable as an example, Congress may not be satisfactory as an authority."[2]

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2 R.K. Olding, "Form of Alphabetico-Specific Subject Headings and a Brief Code", in Australian Library Journal, Vol. 10, issue of July 1961, p. 232.

In subject indexing of small collections, Sears' List[3] has worked satisfactorily.

There also have been subject heading lists in specific subject-fields. The following can be listed as examples:

a) Margaret Mann, List of Subject Headings for Children's Books, published in 1916.

b) National Library of Medicine, U.S.A., Medical List of Subject Headings. It is used in the "Current List of Medical Literature".

c) Engineering Index Inc., Subject Headings for Engineering. It contains more than 16,000 subject headings.

d) Voigt's list for Physics.

e) Julia Pettee's List of Theological Subject Headings.

Henry Black has enlisted such special subject heading lists.[4] There is also a Bibliography of Subject Heading Lists, 1938-52[5] which has enumerated more than fifty special lists.

3) Need for standardization. - A critical examination of the existing subject heading practice shows that, to quote

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3 M. E. Sears, List of Subject Headings, 9th ed., New York, Wilson, 1965.

4 Henry Black, "Special Lists of Subject Headings: a Tentative Check List", in Catalogers' and Classifiers' Yearbook, Vol.IX, 1940, p. 54-67.

5 A. Khurshid, et al., "Philosophy of Subject Cataloguing", in Pakistan Library Review, Vol.3, issue of Sep. - Dec. 1961, p. 45.

the analogy used by M. F. Tauber, there is no complete code of practice which will make clear to subject cataloguer what Merrill's code does for classifiers of books. What we need is a clear theory or flexible guiding principles so that the process of adjustment with the requirements arising from time to time could be continued. Prevost suggested:

> The only way to produce a clear theory is to cast loose all ties with the past for the time being; to analyze our objectives and our practices; and then to reconstitute[6].

Her advice seems to be based on the assumption that the past has nothing to offer. This can hardly be accepted. The existing practice, a result of long human experience, is not all rubbish. What all is to be done is to pick and choose from the old material and use it as building blocks for the new theoretical edifice.

Standardization of subject headings has to move in the direction of better subject control of bibliographical resources. The major problem is of great numbers; the proliferation of scientific literature on one side and the immediacy of Science on the other.[7] Scientific growth is exponential, that is,

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6 M. L. Prevost, "An Approach to Theory and Method in General Subject Heading", in Library Quarterly, Vol.16, 1946, p. 141.

7 D. J. de Solla Price, Little Science, Big Science, New York, Columbia University Press, 1963, p. 1-14.

multiplying by some fixed amount in equal periods of time. Scientific literature is doubled every 10 to 15 years at the rate of at least half a million a year. 80 to 90 percent of all the scientists that have ever lived are alive now. It is estimated that the world population was about 250 million at the beginning of Christian era. By the mid-17th century, it went up to 550 million and in 1950's, it was 3000 million. Thus the world population is doubled every 40 to 50 years and every doubling of population has produced at least three doublings of the number of scientists.

The growing national expenditures of money and man-power on science and technology have made them a major sector of national economies. This led Alvin M. Weinberg to coin the term "Big Science".[8] Large scale participation of government and industry has changed the research phenomena also.

Newer communication media too offer a challange to subject heading work. Emphasis from 'Book' as a significant source of information has shifted to journal-article, report matefial, audio-visual documents, etc. The traditional methods of subject control of information through library catalogues were not compatible with the changed needs. As a result, the

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8 Alvin M. Weinberg, "Impact of Large Scale Science on the United States", in Science, Vol.134, issue of July 21, 1961, p. 164.

indexing and abstracting services were developed. But these too, each with a particular plan of subject indexing of its own, have become confusing; hence, the need for standardization through finding an optimal base for choice and structure of subject headings.

4) The optimal base. - Even though the era of library applications of computer has set in, alphabetical devices cannot be dispensed with. However, the subject heading practice has to leave off the expediency approach and move rapidly towards systematization, necessarily based on a faceted subject indexing method. Can the "Facet Analysis and Sequence" of S. R. Ranganathan fill the needs?

As already pointed out, the "Facet Analysis and Sequence" of S. R. Ranganathan is a transformed "Chain Procedure" to render headings which correspond to specific subject headings of a dictionary catalogue. Although the proposition was made in 1964, no public discussion of the method was found so far. Does it mean that it has been taken for granted to be the same as the "Chain Procedure"? Certainly, it is not. It has great potentialities. Only the extensive experimentation and intensive research can unfold its merits of system-relevance and user-relevance. In the absence of tested evidence, a theoretical evaluation is attempted here.

i) Semantics of the method. - By recommending a step-by-step procedure for formulating a 'Subject Statement', Ranganathan

brought down the acumen of heuristics to an analytic method. This ensures that no loss of necessary details occurs in subject representation of subject headings.

Use of facet-terms in nominative form of nouns relaxes the limitations of natural language so apparent in use of relational elements like verbs and prepositions.

Specificty reached through analytico-synthetic arrangement, or coordination, of facet-terms in subject heading is much deeper than the specificity of specific words and phrases used in standard subject heading lists.

ii) Syntactics of the method. - The subject headings visualised by this method do not suffer with the narrow capabilities of relational elements of alphabetic and other notation in fitting in the total structure of subject index such as the 'Operators' proposed by J. E. L. Farradane[9] and the 'Ramified Keywords' recommended by J. Edwin Holmstrom.[10]

The 'term-significance', basic to any syntax of subject headings, has been adopted by Ranganathan through the use of

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9 J. E. L. Farradane, "A Scientific Theory of Classification and Indexing", in Journal of Documentation, Vol.6, 1950, p. 83-99 and Vol.8, 1952, p. 73-92.

10 J. E. Holmstrom, Facts, Files and Action, Vol.2, London (no publisher), 1953, p. 70-83, quoted by Eric de Grolier, A Study of General Categories Applicable to Classification and Coding in Documentation, Paris, Unesco, 1962, p. 92.

"Wall-picture" principle conditioned successively by the "Canon of Prepotence" and the "Canon of Sought Headings", already discussed at length in the Chapter IV, p.48-49. These guiding principles help subject heading to function efficiently as 'media of communication' and 'points of reference'.

The 'term-relationship' envisaged in 'Forward Rendering' and 'Reverse Rendering' is capable of displaying both linear and non-linear, or multi-dimensional, relationships between the terms used in a subject heading. Genus-species and subject-aspect relations are linear relations such as in 'Oil Emulsions' rendered as 'Emulsions. Oil'. The terms in multi-faceted subject names stand in non-linear, or multi-dimensional, relations, such as in 'Use of Classification in Searching the Scientific Literature' rendered as 'Literature. Science. Searching. Media. Classification'. Rendering of the names of multi-faceted subjects often requires telescoping of terms and filling of ellipses. It may be noted that in the latter example, the terms 'Science' is a telescoped one and the term 'Media' is the one 'filled up'.

Having determined the choice and the rendering of first heading, cross-refefences can be derived from the specific heading (first heading in this method) mechanically, that is, without further going into the semantics of such references. They are easy to be compiled and also easy to be used, but make the catalogue/index bulky. Ranganathan himself has given hints on

this problem by recommending omission of the first or the first few Kernel terms or a few intermediate terms, depending upon the type of rendering ('Forward' or 'Reverse') and the purpose of the subject index or documentation list; whether it is for the generalist user or a specialist user. But, at the same time, he warned that library being a growing organism, two different documents carrying the same specific subject heading but embodying two different subjects might be later received in which case the omitted terms would need to be restored in order to distinguish between the two. E. J. Coates[11] has also proposed modifications of normal syndetic referencing. Here again there is scope for further research to eliminate redundant connective references.

Punctuations pose no problem in this method. The simplification of the types of subject headings to be used makes the problem of using the punctuation marks simpler. Periods are used to identify logical distinctions between facet terms.

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11 E. J. Coates, Subject Catalogues : Headings and Structure, London, Library Association, 1960, Chapter XI.

# SUMMARY AND CONCLUSIONS

The range of subject representation in subject headings under the counter-acting influences of multi-dimensions of subjects and limitations of natural language on one side and of user-relevance on the other side has been the nucleus of the subject heading theory. There are two major aspects of this theory, viz., the semantics and the syntactics. The approaches made from time to time, which constitute the basis of the existing subject heading practice, were either partial or, if comprehensive, not compatible with the changing information needs. It needed identifying the issues involved and evaluating the approcahes critically with a view to formulate a unified approach together with re-statement of objectives and renovation of methodology.

Hypotheses for this study were the adaptability and simplicity of alphabetical arrangement in manual systems of subject indexing as opposed to the classed arrangement and that systematized alphabetico-specific subject headings were preferable over those rendered by the expediency approach. Within the frame-work of these characteristics of a subject indexing system, the "Facet Analysis and Sequence" of S. R. Ranganathan only could be an optimal base.

The universe of study was the whole body of subject heading theories, particularly the trends of systematization which originated with J.C. Schwartz' "Noun Rule". The hypotheses were not tested through experimentation or survey of the use of subject indexes. A theoretical evaluation was attempted.

The functions of a subject index were established in the face of the changing information needs by comparing the psychology of the use of subject indexes with the implications of subject approach. Then the problems posed by the users' experience at subject indexes and the solutions proposed by the subject heading theorists were evaluated against the functions so established.

It was generally assumed that need for a subject heading code was recognized but little research was undertaken in this respect. It was a fact that a perfect subject heading code did not exist, but, at the same time, it was not correct that no effective efforts were made in this respect. The development of subject heading thought did not support this assumption. The profession was mindful of its obligations. Except these who were under the influence of the Library of Congress patterns of subject headings and thus favoured the expediency approach, others contributed significantly towards systematization of alphabetical subject headings and their progress in this direction moved along the temperament of the times. However, such efforts were eclipsed by the large scale application of the expediency approach at the Library of Congress.

It was noted that existence of a code implied rigidity in practice and rigidity of subject heading practice and dynamism of the universe of subjects did not go together. More than a subject heading code, a crystallized theory and flexible guiding

principles were needed so that the process of adjustment with the requirements arising from time to time could be continued.

Search being formulated in natural language, alphabetical subject approach was substantiated and with the use of facet-terms in nominative form of nouns, simplicity and adoptability of alphabetical arrangement in manual systems of subject indexing were established as well. Need for providing "full facilities of reference" and obligations arising from other functions of subject headings established the weaknesses of the assumptions generally held regarding various aspects of subject heading work and supported the essentiality of systematization of subject headings. Potentiality of Ranganathan's "Facet Analysis and Sequence" method as an optimal base for alphabetical subject indexing was demonstrated.

The possibilities of further research were evident in the following areas:

1. S. R. Ranganathan admitted that the syntax of subject headings suggested by him was not unique. Objective statistical surveys could lead to other choices of the arrangement of terms in a subject heading.
2. Choice of first heading from the verbal raw material furnished by "Facet Analysis" could be further systamatised by research.
3. It was felt that cross-references in "Facet Analysis and Sequence" method were easy to be compiled and to be used but made the index bulky. Further research might lead to modification of syndetic referencing.

Thus, the study identified the basis of the existing subject heading practice. For any refinements, definition of the present practice was necessary. The study also contributed emphatically to the subject heading theory by offering solutions to various problems of the choice and structure of subject headings. Its significance was evident in thrashing out problematic areas for further research.

# BIBLIOGRAPHY


Akers, S. Grey, Simple Library Cataloguing, 4th ed., Chicago, ALA, 1954, p. 24-41.
A small simple text on cataloguing. Chapter II, p. 24-41, deals with subject cataloguing.

Bernier, Charles L., "Language and Indexes", in J. H. Shera, et al., Documentation in Action, New York, Reinhold, 1956, p. 325-329.
A concise article, appearing as Chapter XVII-C of the main work, deals with linguistic aspects of subject heading work, as the title indicates. Offers only a partial approach.

--------, "Subject Index Production", in Library Trends, Vol. 16, issue of Jan. 1968, p. 388-397.
Prescribes step-by-step procedure for subject indexing.

Cleverdon, C. W., "An Investigation into the Comparative Efficiency of Information Retrieval Systems", in UNESCO Bulletin for Libraries, Vol.12, issue of Nov.-Dec. 1958, p. 267-270.
Reports on the ASLIB Cranfield Research Project for a comparative study of the four information retrieval systems, namely, the Universal Decimal Classification, Faceted Classification, Alphabetical Subject List and the Uniterm System.

Coates, Eric J., Subject Catalogues, Headings and Structure, London, Library Association, 1960, 186 p.
A good documentation of the literature pertinent to the development of subject heading thought. The author makes his own contribution by elaborating on the relational word-elements in subject headings. Also contains a glossary of alphabetical subject indexing.

Coetzee, P. C., "Syntactics and Semantics of the Subject Headings, an essay in catalogistics", in Mousaion, No.21, p. 1-41; No. 22, p. 1-30; No. 23, p. 1-30, 1957.
A full length treatment of systematic heuristics and formulary of subject heading syntax.

Costello, Jr., J. C., "Uniterm Indexing Principles, Problems and Solutions", in American Documentation, Vol. 12, Jan. 1961, p. 20-26.
A critical study of Mortimer Taube's Uniterm Indexing system. Having identified the problems involved, the author offers solutions also.

Cutter, C. A., Rules for a Dictionary Catalog, 4th ed., Washington, G.P.O., 1904, 173 p.
While prescribing rules for a dictionary catalogue as a whole, the author offers a code of subject heading practice which has influenced the subject heading thought for the last 100 years.

De Grolier, Eric, A Study of General Categories Applicable to Classification and Coding in Documentation, translated from the French text, Paris, Unesco, 1962.
Reviews subject indexing theories. Very comprehensive in treatment and well documented. It is an authoritative work.

Daily, Jay E., "Subject Headings and The Theory of Classification", in American Documentation, Vol. 8, 1957, p. 269-274.
Draws a comparison between classification and alphabetical subject heading work and studies the significance of grammatical categories in subject headings and their use in Library of Congress list.

Dewey, H. T., "Basic Subject Heading Theory", in M. F. Tauber, "Subject Headings and Codes", in Library Resources and Technical Services, Vol. 3, issue of Spring 1959, p. 97-101.

Identifies very briefly the principles underlying the subject-heading practice.

Dubester, H.J., "Mechanization and Subject Headings", in Library Resources & Technical Services, Vol. 6, issue of Summer 1962, p. 230-234.
As indicated by the title, gives a short but lucid account of the prerequisites and the consequences of mechanization of subject heading work.

Eaton, Thelma, Cataloguing and Classification, 2d ed., Champaign, Ill., Illinois Union Book Store, 1957, p. 111-137.
A general text on cataloguing and classification. Chapter V and VI deal with subject cataloguing.

Engineering Joint Council, Thesaurus of Engineering Terms, 2d ed, New York, The Council, 1967.
An authoritative vocabulary for subject analysis of publications on Engineering. Includes critical comments on the role of thesaurus in information retrieval systems.

Farradane, J. E. L., "A Scientific Theory of Classification and Indexing", in Journal of Documentation, Vol. 6, 1950, p. 83-99; Vol. 8, 1952, p. 73-92.
Introduces the concept of "analets" containing relational symbols called "operators". Claims his system provides "an irreproachably logical index".

Frarey, C.J., "The Role of Research in Establishing Standards for Subject Headings" in Journal of Cataloguing & Classification, Vol. 10, issue of Oct. 1954, p. 170-190.
Reviewing the proliferation of literature and emergence of newer communication media, points out the inefficiency of the existing systems of information retrieval and emphasizes the need for standardization.

--------, Subject Headings, New Brunswick, N.J., Rutgers University Press, 1960, 92p.

An elaborate study of subject heading problems. Also reports on the various surveys of the use of subject catalogues.

Goffman, W. and Newill, V. A., Methodology for Test and Evaluation of Information Retrieval Systems, Comparative Systems Laboratory Technical Report No.2, Cleveland, Center for Documentation and Communication Research, Western Reserve University, 1964.

Prescribes a model for testing the performance of an information retrieval system.

Harris, J. Lee, Subject Analysis, Computer Implications of Rigorous Definition, Metuchen, N. J., Scarecrow, 1970, 279p.

Based on D.L.S. Thesis of Columbia University, 1969. While discussing the computer applications of subject heading work, the author identifies the problems of conventional subject heading work.

Haykin, D. J., Subject Headings, a practical guide, Washington, G.P.O., 1951, 140p.

An elaborate code for subject heading work. The author being the chief of the subject cataloging division, Library of Congress, authoritatively represents the subject heading practice followed by the Library of Congress.

--------, "Subject Headings, Principles and Development", in M. F. Tauber, Subject Analysis of Library Materials, New York, ALA, 1957, p. 43-54.

Presents a concise account of subject heading principles.

Herner, Saul, "Information Gathering Habits of Workers in Pure and Applied Sciences", in Industrial and Engineering Chemistry, Vol. 46, issue of Jan. 1964, p. 228-236.

Reports a study made at John Hopkins University.

The findings given by the author are useful in designing an information retrieval system.

Jackson, S. L., "Schrettinger on Class and the Subject Heading, a Note on Early 19th Century Thinking", in Library Resources & Technical Services, Vol. 14, issue of July 1970, p. 579-581.

A short-length article reporting on a discussion of "Systematic" versus alphabetical catalogue" dating back to 1829.

Jayarajan P., "Developments in the Universe of Subjects, Changes in Systems for Document Finding, and User Problems, India's Contribution to a Solution, in IASLIC Bulletin, Vol. 16, 1971, p. 108-118.

Brings out the changes occuring in the universe of subjects on one hand and in the research phenomena on the other hand and reaffirms the utility of a faceted classification in a SDF (System of Document Finding).

Jolley, L., Principles of Cataloguing, London, Crosby Lockwood, 1960, 147p.
A simple but standard text on cataloguing principles. The portion from p. 98 to 125 deals with subject cataloguing.

Kaiser, J., Systematic Indexing, London, Pitman, 1911,
The author develops his 'Concrete-Process' formula from Schwartz' Noun Rule which influenced the later subject indexing theories.

Khurshid, A., et al., "Philosophy of Subject Cataloguing", in Pakistan Library Review, Vol. 3, Sept. - Dec. 1961, p. 39-45.
Reviews the development of subject headings through the ages and also identifies the underlying principles; not comprehensive in coverage.

Mack, J. D., "Role of Language in the Documentation of Recorded Information", in J. H. Shera, Documentation in Action, New York, Reinhold, 1956.
Useful in the study of the linguistic problems of subject headings.

Mann, Margaret, Introduction to Cataloguing and Classification of Books, 2d ed., Chicago, ALA, 1943, p. 136-150.
A standard text on cataloguing and classification. Chapters IX and X deal with subject cataloguing.

Metcalfe, J. W., Information Indexing and Subject Cataloguing, New York, Scarecrow, 1957. 338 p.
A critical account of the development of subject indexing theories. Strongly supports the dictionary catalogue. Comprehensive in scope and scholarly in the treatment of the subject.

--------, Subject Classifying and Indexing of Libraries and Literature, New York, Scarecrow, 1959, 347 p.
Almost identical in treatment. Also contains a "Tentative Code" for subject heading practice spread over p. 263-292.

Mills, J., "Chain Indexing and the Classified Catalogue", in Library Association Record, Vol. 57, issue of April 1955, p. 141-148.
A good exposition of S. R. Ranganathan's "Chain Procedure" for subject cataloguing. Contains worked out examples of chain indexing with Universal Decimal Classification, Library of Congress Classification, Dewey Decimal Classification, etc.

Neelamegham, A., Classificationist and the study of the Structure and Development of the Universe of Subjects, Copenhagen, Danish Centre for Documentation, 1967.
Discussing the modes of the formation of subjects, points out its significance to the subject analyst in designing an information retrieval system.

Olding, R. K., "Form of Alphabetico-Specific Subject Headings, and a Brief Code", in Australian Library Journal, Vol.10, issue of July 1961, p. 127-137.
A criticism of Haykin's thinking on subject heading principles. The author also treats Cutter, Kaiser and Metcalfe.

Pettee, Julia, Subject Headings, the History and Theory of the Alphabetical Subject Approach to Books, New York, Wilson, 1946, 191p.
As the title indicates, it traces the development of subject heading theories and constitutes a significant contribution to the literature of the field.

Prevost, M. L., "An Approach to Theory and Method in General Subject Headings", in Library Quarterly, Vol. 16, 1946, p. 140-151.
Analyzes the implications of expediency approach and systematic approach to subject headings and prescribes a set of rules with examples.

Price, D. J. de Solla, Little Science, Big Science, New York, Columbia University Press, 1963.
Brings out the important features of the growth of Science and Research, such as, immediacy, doubling of scientific literature every ten to fifteen years, etc.

Quinn, J.H., and Acomb, H. W., A Manual of Cataloguing & Indexing, London, Allen & Unwin, 1933, p. 127-249.
A standard text on the subject. Part II deals with subject entries.

Ranganathan, S. R., "Theory of Library Catalogue", in his Dictionary Catalogue Code, 2d ed., Madras, Madras Library Association, 1952, Chapter II.
One of Ranganathan's basic writings. The "Chain Procedure" was first described in this work.

--------, Chain Procedure and Dictionary Catalogue, in Annals of Library Science, Vol.1, issue of Dec. 1954, p. 216-221.
Evaluates the use of "Chain Procedure" in a dictionary catalogue and emphasises the need for further survey of users' approach so that rules could be framed to make the "Chain Procedure" suitable for a dictionary catalogue also.

--------, "Homonyms in Class Index Headings", in Annals of Library Science, Vol. 10, issue of Sep. - Dec. 1963, p. 158-160.
Prescribes the rules to meet the problem of homonyms in subject headings.

--------, Classified Catalogue Code, with Additional Rules for Dictionary Catalogue Code, Madras, Madras Library Association, 1964, 644 p.
Chapter CG deals with subject entries and contains rules for the "Chain Procedure".

--------, "Subject Headings and Facet Analysis", in Journal of Documentation, Vol.20, issue of September 1964, p. 109-119.
Introduces the method of "Facet Analysis and Sequence" for subject headings.

Scheerer, G., "A Subject Catalogue Examined", in Library Quarterly, Vol.27, issue of July 1957, p. 187-198.
A good-length article on the principles of subject headings.

Sears, M.E., List of Subject Headings, with Suggestions for the Beginners in Subject Heading Work, by B.M. Frick, 9th ed., New York, Wilson, 1965, 610 p.
The article by B.M. Frick mentioned in the sub-title from p. 11 - 28 is a short account of the principles underlying the existing subject heading practice.

Sharp, Henry A., Cataloguing, 5th ed., Bombay, Allied, 1964, 388 p.
A standard text on cataloguing. Chapter VIII, p. 83-98, deals with subject entries.

Taube, Mortimer, "Specificity in Subject Headings and Coordinate Indexing", in Library Trends, Vol.1, issue of Oct. 1942, p. 219-233.
Compares the specificity achieved by the two systems in order to prove the superiority of coordinate indexing.

--------, "Notes on the Use of Roles and Links in Coordinate Indexing", in American Documentation, Vol.12, issue of April 1961, p. 98-100.
Describes the 'Role Indicator' and 'Relationship Link' devices used in Uniterm Indexing.

Tauber, M.F., "Subject Headings and Codes", in Library Resources & Technical Services, Vol.3, issue of Spring 1959, p. 97-102.
Summarises and comments on the papers presented at the meeting of the Cataloguing and Classification Section of ALA - RTSD (Resources & Technical Services Division) held in San Francisco on July 18, 1958.

Thirmalaimuthuswamy, A., "Chain Procedure", in Library Herald, Vol.7, issue of April 1964, p. 71-79.
Stating the origin and development of the "Chain Procedure", discusses its main functions and advantages.

Vickery, B.C., "Systematic Subject Indexing", in Journal of Documentation, Vol.9, issue of March 1953, p. 48-57.
Emphasising the display of subject relationships, advocates that a subject index must be based on analytico-synthetic classification.

--------, Classification and Indexing in Science, 2d ed., London Butterworth, 1959, 185p.
Discussing the principles of subject headings, advocates the concept of a "fully flexible indexing system" for providing full facilities of reference.

--------, "Thesaurus -- a New Word in Documentation", in Journal of Documentation, Vol. 16, issue of December, p. 181-189.
Discusses the Thesaurus approach to vocabulary control in an information retrieval system. Comments on a few latest thesauri.

Wells, A.J., "Use of Chain Procedure in Constructing the Alphabetical Subject Index to a Classified Catalogue" in M. Pigott, Editor, Cataloguing Principles and Practice, London, Library Association, 1954, p. 61-63.
Describes the application of Chain Procedure in the BNB (British National Bibliography).

Williams, T.M., "Language Engineering", in J.H. Shera, et al, Documentation in Action, New York, Reinhold, 1956, p. 330-337.
Presenting a systematic approach to linguistic problems of subject heading work, emphasises the range of subject representation in headings.

ABSTRACT OF

Analytical Study of Semantic and Syntactic Approach to Subject Headings : Review of Issues, Problems and Solutions[1]

The alphabetical subject indexing theories were studied critically under the two major aspects, viz., semantics and syntactics, with a view to elucidate the basis of the existing subject heading practice. The approaches made so far were found to be either partial, or in compatible with the changing information needs; hence, the need for a unified approach to alphabetical subject control of information with re-statement of objectives and renovation of methodology. The hypotheses of the study were the adaptability and simplicity of alphabetical arrangement in manual systems of subject indexing as opposed to the classed arrangement and that the systematized subject headings were preferable over those rendered by the expediency approach. The study demonstrated that S. R. Ranganathan's "Facet Analysis and Sequence" method could be an optimal base for alphabetical subject indexing. Significant problems were identified for further research.

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1 Mohammed Talib Hussain, thesis presented to the Library School of the University of Ottawa, Ontario, as partial fulfillment of the requirements for the degree of Master of Library Science, October 1972, xiii-110 p.

# ANALYTICAL INDEX

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