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Library Classification in Computer Age

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Abstract

Library classification is constantly being influenced by multifaceted, multidimensional, and infinite growth of literature on one hand and the users needs on the other. Dewey pioneered in devising a scheme of classification for the documentation utility of the organised knowledge. Subsequent schemes of classification worked purely without any theoretical foundation, colon classification being the exception. With the emergence of computer technology the library classification is being metamorphised. This paper attempts to delve a state-of-the-art of library classification in the new computer age.

1. INTRODUCTION

The discipline—Library Classification—is conditioned by the constant multifaceted, multidimensional and infinite development of the macro and micro knowledge and users needs. Change is the law of nature and whatever does not change with the changing needs and demands becomes static and redundant like a piece of artefact in a museum. Accordingly, it has been the attempt of library and information scientists, associations and institutions to work in the direction of making library classification a living discipline, a discipline which can cope with the ever-growing and infinite demands and challenges both of knowledge and users of libraries and information centres.

2. ERA OF TRADITIONAL SCHEMES: THE INDIVIDUAL EFFORTS

It was Melvil Dewey upon whom dawned the realisation of the utility of organised knowledge and he became the pioneer in devising a classification scheme for classifying documents of the libraries on the basis of which the disorganised libraries henceforth could be organised in a helpful manner. So the genesis of a scheme for the systematic arrangement of documents heralded in 1876 under the name Decimal Classification. This idea subsequently sprouted in many more corresponding classification schemes, such as Expansive Classification of Cutter, Subject Classification of Brown, Universal Decimal Classification of FID, and Library of Congress Classification.

All these schemes were purely practical classification schemes without any theoretical foundation and designed with narrow and limited objectives. These, however, greatly contributed in the furtherance of library classification. The need for a theory of classification became conspicuous after the publication of Sayers *Canons of Classification* (1915)—a small book providing elementary rudiments of the theory of library classification. Thereafter appeared his monumental works *Introduction to Library Classification* (1918) and *Manual of Library Classification* (1926). The works of Sayers changed the direction of the discipline of library classification. Bliss added a new feather to this by writing his two scholarly works—*Organisation of Knowledge and the*

Systems of Sciences (1929) and *Organisation of Knowledge in Libraries and the subject Approach to Books* (1933) in which he also expounded his 32 principles for library classification. Thereby, a new idea was propagated that the design of a scheme for classification should be based on a sound theoretical foundation. But, it was Dr SR Ranganathan who sensed the nature of the multidimensional universe of knowledge *vis-a-vis* the changing needs of the users of the libraries. A scholar of mathematics, logic and Hindu philosophy, he easily visualised the required parameters for a theory-based practical classification and the way it was going to benefit both the libraries and the information centres and their users. He, therefore first wrote a monumental work, *Five Laws of Library Science* (1931) which enunciated the guidelines for all library operations and services including library classification. This work laid the foundation for all his future works and theories for library classification. The genesis of Five Fundamental Categories, the terms Facets, Focus, Phase, etc., changed the whole arena of library classification and resulted in, what may be called the first revolution in the realm of library classification. Thus the classificatory concepts changed gradually from Enumerative (1876) to Almost Faceted (1905) to Rigidly Faceted (1933) to Freely Faceted Classification (1952).

3. COLLECTIVE EFFORTS

3.1 Classification Research Group

Stage I—Special Schemes: Till 1950s the individual classificationists dominated the library classification scenario. However, *Bibliographic Classification* of Bliss and *Colon Classification* of Ranganathan were viewed by the international scholars as a mere theoretical rhetorics and interesting curiosities. To them, these schemes could in no way be solutions for problems created by the limited notational system and inherited limitations of the existing schemes in use like DDC and LC, for grappling the vast plethora of the published literature. In this backdrop, the Classification Research Group (CRG), London, came into existence in 1952 with only a dozen of active members who mainly were librarians of special libraries fully conversant with the difficulties and travails in the use of existing general classification schemes. The long experience in the use of these schemes became the focal point for CRG to design the special scheme to meet the demands of modern information users. Consequently, the members of the CRG produced innumerable schemes based on some original ideas and techniques which influenced the shape and direction of the trend of modern classificatory research. The Group members also utilised terms and techniques of Colon Classification, such as Facet and Facet Analysis. Whereas, the user of PMEST was more conspicuous in the categories. Sequel to this, many faceted special schemes were constructed by the members of the CRG, such as—Soil and Earth Sciences; Classification for Astronomy and also *Faceted Classification—a guide to the construction and use of special schemes* by BC Viceroy; Metal Box Company's Classification, *Scheme for Food Technology* and *Scheme for Health and Occupational Safety* by DJ Foskett and *Scheme for Music* by EJ Coates. JOEL Faraday, another important member of CRG, propounded the concept of relational operators, which he used with uniquely definable items of knowledge termed as *isolates. The relations symbols inserted between* these isolates were termed as operators.

Stage II—General Classification Scheme: The concept of special schemes could not yield the desired results. The classificatory problems remained the same as were initially during Stage I. Again the solace was sought in the construction of a New General Scheme. The desirability of a new general classification was, therefore, envisaged in the two conferences held in England in 1957—Dorking Conference; and Reference and Special Libraries Section Conference. In 1962, NATO report *Increasing the Effectiveness of Western Science* appeared which also recommended a new scheme of classification for science and technology. NATO Science Foundation awarded a grant of £5,000 to the Library Association to study the project. Library Association entrusted this task to CRG. In 1963 CRG's plan for research into a new general classification was formally launched. Two research assistants—Mrs Helen Tomlinson

1964-67 and Derek Austin 1967-68 were appointed to work on this project. The result of the project was addition of few new terms and concepts in the classificatory terminology—such as Artefacts—man-made or processed entities; Mantefacts—Entities constructed by human mind and the theory of integrative levels for the arrangement of the entities.

3.2 International Conferences

The themes of discussions of the six international study conferences on Classification Research held between 1957-1997 are the indicators of the changing requirements in library classification. These conferences became the rallying forum to highlight and project the challenges of scientific and technological developments, the deluge of published macro and micro literature and their revolutionary impact on library classification. The Dorking Conference (1957) examined and evaluated the theories propounded by Dr Ranganathan to overcome the problems resulting from the use of enumerative classification. It resolved that the most helpful form of classification scheme for information retrieval is one which groups terms (isolate ideas) into well-defined categories which can be used independently to form compounds and within which the terms (isolate ideas) can be arranged in hierarchies. The Conference, therefore, gave in positive terms the message that the era of faceted classification has begun.

3.3 FID/CR

This change was also visible in the attempts of FID to replace the Committee on Classification Research with new objective visualising the vital role it had to play in the development of classification. In 1950, FID had established the Committee on General Theory of Classification (FID/CA) which was replaced by Committee on Classification Research (FID/CR) in 1961. In 1986, it was replaced by Committee on Classification Research for Knowledge Organisation (FID/CR) in accordance with the contemporaneous theories and principles in the discipline of library classification and developments in scientific and technological fields. Accordingly, the scope of the Committee was also expanded to promote, sponsor and engage research in the field of classification as it applies to all aspects of knowledge organisation in storage and retrieval systems and all areas of information handling.

4. ERA OF COMPUTER AND INFORMATION TECHNOLOGY

During 1950s, rapid strides in scientific and technological advancements took place when new areas like space science became the subject for interdisciplinary research. The natural outcome of this was a deluge of literature containing multifaceted micro subjects. As already described, the various solutions were put forward by individual scholars as well as professional groups to face the onslaughts of the new knowledge explosion. Ranganathan thought the solution lies in a self-perpetuating analytico-synthetic scheme; CRG found the solution in designing special schemes, while others thought to use something which is not classification and experimented with various systems of word combinations. Mortimer Taube even thought that his uniform system would solve all indexing problems without using subject classification. But the indexing systems had to take help of the thesauri, while the CRG finally decided to design a new general classification scheme. However, with the advent of computer technology and other electronic systems and their unlimited potentialities for providing faster and better information services and handling library operations, the library scientists had to undertake entirely new exercises to cope with the demands of the newly emerging technologies. The new action plan was therefore, activated in two ways: (i) to modify the existing library techniques to suit the needs of new technology; or (ii) to develop new methods and techniques on the basis of the demands of computer and other electronic systems. In so far as library classification is concerned the classificationists had either to experiment the extent to which the existing schemes with or without changes and modifications can be used in the information storage and retrieval systems or if new schemes need to be designed for the said purpose.

4.1 The Existing Schemes

The existing schemes have undergone many tests and experiments for their compatibility with information storage and retrieval systems. The following are some examples:

4.1.1 Faceted Classification

(i) Universal Decimal Classification

As early as 1934, in the general introduction to the full English Edition of UDC-BS 1000, Vol. I Pt. I, it was argued that the UDC was suitable for mechanical sorting. In 1948, the Royal Society's Working Party on Mechanical Indexing had noted that 'the UDC system (is) the only (form of indexing the contents of a paper) worked out in detail for the whole of science. This is ready for machine coding.' However, it was only in the middle of 1960s that some pioneering work started to test the viability of UDC as an indexing languge for computerized control and processing of information in all fields of knowledge. The first attempt in this regard was made by M Rigby who presented in Elsinore Conference (1964) the printout of *Meteorological and Geoastrophysical Titles* that has started the use of computer for author and subject indexing (UNIDEK).[1] However, the first online bibliographical retrieval system using the UDC was demonstrated in 1967-68 by Robert R Freeman and Pauline Atherton who then observed that 'there is no longer any doubt that the UDC can be used as the indexing language in a mechanised system .... in either batch–processing or interactive mode.' A more complete survey on the use of computers with the UDC was compiled by Rigby in 1974 which described about sixty empirical and operational systems in fifteen countries and four international projects.[2]

(ii) Colon Classification (CC)

Doc. Finder: To Ranganathan, the term computer was improvised to do calculation. In finding documents there is no calculation. Therefore, the term computer is not appropriate. Further, the efficiency of finding documents will become greater if the electronic machinery used is the special purpose Doc. Finder instead of the general purpose computer.[3]

Experiments Conducted in DRTC: The DRTC Research Cell started conducting experiments on the use of electronic machinery in document finding starting from May 1968. One of the objectives of the series of experiments conducted was to examine the feasibility of using a conventional general purpose computer in document finding system using a freely faceted version of CC.[4] Experiments were also carried out to design a special purpose computerised document searching and called Doc. Finder. Number of papers were written on these experiments and published in *Library Science with a slant to Documentation*, Vol. 5 and 6. In a paper published in 1970s about information retrieval system based on CC described a set of fifteen programmes which provide for storing and updating a reference catalogue, a classification schedule, an alphabetical index to the schedule and a catalogue of user profiles.[5]

Michael Shepherd of the School of Computer Science, Canada, also conducted a set of experiments in 1981 to determine the suitability of CC as a basis for automated analysis, representation and retrieval of primary information from the full text of documents. He, however, concluded stating that the CC-based systems[6] did not perform significantly better than the other systems. However, Michael A Shepherd and CR Watters in a paper presented in International Conference on Ranganathan in 1985, demonstrated that the recent developments in the area of relational database management system (DBMS) are making it feasible to take the advantage of faceted classification, such as CC for information retrieval. The purpose of this paper was to demonstrate that, in addition to traditional Boolean retrieval, relational DBMS can provide sophisticated retrieval based on the faceted structure of subjects. It can readily provide answers to such question as: What are the matter isolates of a given Personality? what is the facet string for a particular document? To them the use of such a relational structure may even be able to provide the basis for common retrieval language as suggested by Ranganathan[7].

Faceted Principle: Several empirical studies have also been conducted to prove that the faceted principle propounded by Ranganathan is extremely useful in computerised information system. This is evident from the works of Winfried Godert and Hemlata Iyer (1991).

Godert illustrated the use of faceted principle in online retrieval system. For this purpose, he adapted Buchanan's Short Classification Scheme for Zoology and the notation of the classification scheme as is used in Library and Information Service Abstracts (LISA). On this basis, Godert demonstrated with examples the possibilities of using faceted classification in online retrieval system and found that the faceted classification systems in some respect are superior to other techniques of online retrieval as far as facet and concept analysis is combined with an expressive notational system in order to guide a form of retrieval which will use Boolean operators (for combining the facets of one special citation order) truncation for retrieving hierarchically different sets of documents[8].

An experiment of comparative retrieval strategies was conducted by Iyer, where the faceted search model was compared with two other types of searches: Quorum Function Search and Online Boolean Search. The retrieval results indicated that the faceted model search perform at a higher level of precision and recall than the other two search models. It was also found that structuring the queries using Ranganathan's theory is helpful in the process of searching and retrieval.[9]

4.1.2 Enumerative Classification

(i) Library of Congress Classification (LCC)

The Library of Congress Classification is now available in US MARC Format. With this the US MARC format for Classification Data joins the family of MARC (Machine Readable Cataloguing) formats. The machine readable format for classification data has been developed to allow for communication of classification records between systems and to provide a standard for the storage of classification data in the computer. The format was developed between 1988 and 1990 in close consultation with two major classification schemes in use in the United States—Library of Congress Classification and Dewey Decimal Classification (DDC). By 1994, about two-thirds of the LCC schedules had been converted to machine readable form. It was expected that the entire conversion will be completed by the end of 1995. The Cataloguing Distribution Service will also distribute the records as a MARC distribution service and is exploring a CD-ROM product. Once all the schedules are converted in the US MARC classification format, it would be possible to search across the classes enabling the user to have access to a wider range of material. Moreover, incorporating classification data in online systems would result in the addition of rich subject terminology for online searching.

The US MARC format for classification data contains specifications for converting classification data into machine readable form for communicating and storing classification data. US MARC classification records provide the authority for classification numbers and their captions. Each classification number of caption is given its own US MARC classification record, which may include not only the number and caption, but also any notes or other information associated with it.[10]

(ii) Dewey Decimal Classification (DDC) Online Projects

In January 1984, a research team in the OCLC Office of Research undertook the DDC online project. The project was supported by the Council on Library Resources, Forest Press, and OCLC. The project had the following objectives :

- to use the consensus of DDC experts to determine strategies for searching, browsing and displaying DDC in an experimental online atalogue;
- to implement and demonstrate these strategies in this catalogue;
- to test the effectiveness of DDC as a searcher's tool for subject access, browsing and display in this catalogue; and
- to evaluate and disseminate the research findings.

The project team incorporated records from DDC 19 Schedules and Relative Index into an experimental online catalogue. The libraries which provided machine readable cataloguing records to the experimental online catalogue's database in selected subject areas are—Library of Congress (Management); New York State Library (History and Geography); Mathematics Library of the University of Illinois at Champaign-Urbana (Mathematics); and Public Library of Columbus and Franklin Country (Recreation). Users of the experimental online catalogue were library-patrons of these four libraries who also volunteered to take part in online retrieval experiments to test the effectiveness of DDC as an online searcher's tool for subject access, browsing and display[11]. The principle investigator for the project was Karen Markey, the research scientist of OCLC. Results of the experiments were examined at a meeting held in Dublin, Ohio in January 1986, in which 30 invited participants reviewed the results of the research. The final report of the DDC online project is available from OCLC. Results of the online retrieval experiments using this experimental catalogue demonstrated that DDC provided new and fruitful subject searching capabilities that were not possible through the alphabetical and keyword searching permitted by existing online catalogue.

(iii) DORS-DDC Online Retrieval System

An experimental classification interface called the Dewey Online Retrieval System (DORS) was developed at the University of California, Los Angeles, under the direction of Professor Elaine Svenonius. DORS consisted of four components:

(a) a database comprising the DDC 700 (Arts) Schedules DDC-20;

(b) a database of bibliographic records;

(c) a database of Library of Congress Subject Headings (LCHS); and

(d) a Chain. Index to the schedules which was created automatically by extracting significant terms from the schedules and the DDC Relative Index and then constructing them into chains based on their hierarchical relationships.

DORS was developed to conform to the following specifications:

* interface should provide vocabulary enhancement;
* interface should support call number searching;
* interface should support global browsing;
* interface should enable the users to investigate easily and effectively through the classification; and
* interface should be compatible with other methods of subject access.

Given a database of bibliographic records (titles) that contain both LCSH headings and DDC numbers, DORS facilitates switching from an LCSH search to a DDC search and vice-versa. However, the usefulness of DORS as online catalogues is yet to be tested[12].

4.2 New Schemes and Techniques

The character and direction of library classification research underwent a change after the emergence of computer technology during 1960s. It became the core area of discussions in local, national and international meets, seminars and other related platforms. The first important confabulation in this regard was held in a conference held in London (1963) where CRG's plan for research into a new general classification scheme was formally launched. One of the important guidelines stipulated was that 'the new general classification scheme should be for manual retrieval of books on shelves and entries in indexes, but it should aim to reach the maximum possible, compatibility with machine retrieval systems.' At the Second International Study Conference on Classification held in Elsinore, Denmark, in 1964, automatic classification was discussed at length to understand the utility and viability of the automated classification systems. The final conclusion that emerged from these discussions was that 'automated classification includes: (i) the mathematical derivation of classification schedules (the work of classificationist) and (ii) the automated assignment of documents to categories (the work of classing which is the work of the classifier), regardless whether the categories were automatically derived or were

chosen from a classification scheme previously devised.' Since then, automatic classification has been the subject of debate and discussions in almost all the international conferences held in 1975, 1982, 1991 and 1997.

4.2.1 Thesaurofacet

The English Electric Company's Classification for Engineering was the largest faceted scheme designed by the members of CRG. The first edition of this scheme appeared in 1958 and the third edition in 1961. With the advent of computer technology, the scheme was accordingly revised and published in 1970 entitled *The Thesaurofacet: A Thesaurus and Faceted Classification for Engineering and Related Subjects.* Thesaurofacet is a scheme in which classification scheme is combined with fully structural thesaurus as Index. The classification section displays the universe of subjects displaying hierarchical relations while the thesaurus section displays related terms, broad terms and narrow terms. In the classificatory terminology thereby a new term Thesaurus was added by Aitchison who constructed the scheme[13]. However, research on automatic document classification started during 1960s according to which document surrogates may be grouped using the counting and matching operations of the computer.

4.2.2 SMART System

One such system was developed at Harvard University by Salton and his associates who conducted a wide variety of term-based document clustering experiments and named the system as Salton's Magical Automated Retrieval Technique (SMART). The system stores document texts and matches the words and phrases in search queries to words in the text.

4.2.3 Keyword Classification

Sparck-Jones and her associates developed a keyword classification in which keywords are grouped automatically. The system was experimented at the Cambridge University Computer Laboratory. The System is based on the theory of Clustering or Cloumps[14].

4.2.4 Concept of Switching Language

During 1970s, a pilot project BSO was launched by UNISIST with which eminent library science scholars like EJ Coates, I. Dahlberg, DJ Foskett, etc., were associated. As a result, the Broad System of Ordering (BSO) was designed to function as a switching language or link language or intermediate language between two information systems of a network using different indexing languages. It led to the publication of *Broad System of Ordering–Schedules and Index* in 1978. An expanded version of the BSO is now available on computer disc. However, the scheme has not proved a success. In her recent article, Dr Dahlberg narrates the incidents of this project giving reasons as to why the scheme could not be used as a switching language and remained only a theoretical proposition. Thus the scheme eventually ended up on the Coate's BSO[15].

BSO is a faceted general classification system or a coded classification of about 4000 subjects which are arranged at three levels– subject areas, subject fields and subject field divisions. The scheme is greatly influenced by Ranganathan's ideas (For detail See Library Classification: Theory and Principles by P Dhyani, Wishwa Prakashan, N.D., 1998, pp. 354-359, 263-63).

4.2.5 Information Coding Classification (ICC)

Dr Dahlberg too has developed a Universal Ordering System for disciplines and domains that provides for cross disciplinary combinations and domain interaction with a potential to function as a switching language. According to her it can be used as a switching language between many different languages.[16] Dahlberg has also prepared in 1980 Guidelines for the establishment of compatibility between information language in social sciences for UNESCO which is an unpublished document wherein she stressed that interesting results in harmonisation have been reached in the field of energy and medicine but at the price of huge financial efforts.

4.2.6 Reference Language

However, according to J Maniez, the celebrated French coordinator of ISKO, a

switching language should fulfil three main conditions:

(a) to allow for bi-directional convertibility with all information languages Lx-L and SL-Lx;

(b) to reach the same level of specificity as the most specific information language, so that the loss of information should be minimized in the course and the double translating process;

(c) as a standard, to react naturally to a natural language and consequently, to be artificially coded.

To him, no information language can provide bi-directional convertibility with all other information languages. He, therefore, suggests the concept of Reference Language which has to fulfil all the requirements of a switching language except the condition of bi-directional convertibility. The process of conversion in Reference Language is bilateral and unidirectional as with the concordance tables in which the two column tables establish the closest possible corresponding index terms between A and B, but the number of tables and conversion programmes amounts only to that of the different languages, i.e., 12 tables for 12 languages. However, to Maniez the role of this reference tool will differ depending on whether the choice of the type of information language take place at the starting point or at the final point of the conversion. If the concordance tables are oriented from the Reference Language to the various information languages, then Reference Language would be nothing but a classification scheme and if the concordance tables are oriented from the information languages to the Reference Language then it would be a universal thesaurus. Then all the indexing formulas would automatically be converted into a general language, i.e., IL-RL and the queries should themselves be expressed.in RL. (Maniez, 1997, p. 222).

In a seminar on the compatibility of Information Languages held in Warsaw on 13-15 September 1995, about 25 papers were presented. The scholars provided various solutions and theories relating to compatibility of indexing languages. For example to G Riesthuis of Netherlands there are two simple solutions (i) not to use a controlled information language at all; and (ii) to get everyone to use the same information language. Whereas to Barbara Sosinska-Kalata of Poland, the UDC as an international standard for knowledge organisation in bibliographic databases and library catalogues is the best language.

5. CONCLUSION

If we look retrospectively at the fundamental basis of classification for the helpful and logical arrangement or clustering of documents from Dewey era to computer age, categorisation of universe of subjects has been the core factor. Both human beings as well as machines use one or the other form of classificatory language for the purpose of classification or categorisation. As already observed with the advent of computer technology varied methods have been evolved and experimented to provide a proper and helpful classification system for use in information storage and retrieval system. However, the problem of compatibility still remains the potent subject for further research. Many of the scholars are still of the view that 'there is no substitute for classification' and the human classification has all the advantages over computer technology or that computer is not intelligent–it is an idiot. It is not able to understand the meaning of terms, nor to appreciate the relationship between them[17].

To Ranganathan, 'classification involves judgement–judgement of the subject of the document in all its facets and arrays manifest in it.' Therefore, 'classification will have to be done by human, until the computer can have the faculty of judgement built into it. Even then can the computer be made to do research in classification.'[18] As is evident, Artificial Intelligence (AI) is superimposed in a computer by Natural Intelligence (NI). Its *raison d'etre* or very existence depends on NI. In the construction of a scheme of classification the classificationist is free to use any and many principles and theories which he thinks are helpful to the users of the libraries. No such freedom can be exercised in designing a coding system for information storage and retrieval system as the freedom of the classificationist is

conditioned by the limitations of the computer. Similarly, a classifier knows what is written in a document which he is classifying, who are its users, and what local variations the class number of a document requires to reach to its readers quickly and expeditiously. Such intelligence, judgement, sensitivity and personal touch is *sine-qua-non* to classification, which a computer can never acquire. May be in future some universally suitable information coding system is evolved. Whatever be the extent of experiments and technological researches in this regard the traditional schemes of classification would stay as an important tool even in the new information storage and retrieval systems. The relevance of classification is eternal.

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