CHAPTER - II

DEVELOPMENT OF CLASSIFICATION IN THE
TWENTIETH CENTURY

INTRODUCTION

In order to deal with the theory of classification it is essential to grasp the outline of the development of classification since 1876 when the first edition of Dewey's Classification was published. Dewey Decimal Classification was a practical classification, whose main outline was based on an inversion of Francis Bacon's famous 'Chart of Learning'. Following on his work we have different streams of opinion, which have led to the existing theories of classification.

First we had Cutter\(^1\) with his attempts to simplify the catalogue and classification scheme, and the development of his work into the Library of Congress scheme of classification. This was complemented by the work of later authors.

\(^1\)C. A. Cutter, Expansive Classification appeared in 1981 but now is out-of-date.
particularly Wyndham Hulme\textsuperscript{2} who wanted a classification of books not knowledge. Brown's Subject Classification led away from the battlefield of theory towards a working practical scheme.

Bliss made classification a lifelong study and produced his classification as a vindication of his theory. UDC was conceived as a bibliographical tool and major developments came with Otlet, Donker Duyvis and others who quickly realized the potentialities of Decimal Classification and made it a precise tool for scientific work.

Ranganathan was considerably influenced by UDC and he sought constantly to discover why things happened as they did, for his own classification. The result of this was his Prolegomena to Library Classification in 1937 and a tremendous amount of stated theory of classification ranging from elementary knowledge to complex theories of division.

In 1933 came the first edition of Ranganathan's Colon Classification, "No other bibliographical Classification has aroused either the enthusiasm or the severe criticism that have been accorded to Ranganathan's scheme."\textsuperscript{3} It may be regarded as the greatest step forward, with regard to the principles of bibliographical classification in the present century.


Ranganathan's influence can be greatly felt on British Classifiers and Classificationists. It is unlikely that his theories would have had the impact it has had on Western Europe but for the Palmer and Wells' book *Fundamentals of Library Classification*. The work of these two writers and Ranganathan's visits to England resulted in the formation of the Classification Research Group in 1952 culminating in the Statement 'The need for a faceted classification as the basis for all methods of information retrieval'.

There are now available in Britain a number of entirely faceted classifications devoted to special subject fields and a new general classification based on these principles is being prepared.

**GENERAL CLASSIFICATION SCHEMES**

A General Classification Scheme may be defined as "A classification which arranges the whole field of knowledge -- the visible and invisible universe -- in logical order." The purpose of a general classification scheme is to enable libraries to arrange their documents and indexes in a sequence that will be most helpful to the user. One of the

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main criticisms directed against librarians, especially by social scientists, has been that the schemes found most widely do not, in fact, produce a helpful arrangement, very often they scatter material that needs to be used together, and not infrequently abolish subjects completely. Many people, for example, are engaged in the study and teaching of Health Education, but this subject has no provision in DC which is used by most education libraries. "Small wonder then", in the words of D.J. Foskett, "if the users receive the impression that the purpose of a classification scheme is to enable librarians to carry out some obscure function of their own part of the "mystique of librarianship, which contributes only to the separation of books from readers and as a consequence, of librarians from those whom they are supposed to serve." 6

Most of the present general schemes of bibliographical classifications are, actually collections of special schemes added together; they take a series of 'main classes' and divide each of them as a special system. Most schemes do have certain features common to all or to several classes; but so far no compiler of a general scheme has provided a systematic account of the structure of his scheme, particularly in the relationship between the whole and the

6D.J. Foskett, Classification and Indexing in the Social Sciences. 2nd ed. London: Butterworths, 1974, p.64.
parts. As Vickery has expressed: "Classifications during the last century or so have traditionally been started by dividing up the universe of knowledge into a restricted number of main classes. This restriction -- and the use as main classes of conventional, heterogeneous, over-lapping academic "disciplines" -- is to me unsatisfactory. A new basis for dividing up knowledge into more homogeneous "subject fields" is needed."  

THE LIMITATIONS OF LIBRARY CLASSIFICATION

There are certain limitations of traditional library classification that discredit it as an adequate instrument for the subject interpretation of books. The first of these limitations is associated with the property of linearity in Bibliothecal Classification. A classification that is linear must perforce be uni-dimensional. However, the relationships among books are multi-dimensional and the classifier is compelled to select a single relationship from all the possible relationship which any given title may have.

The second is that of inconsistency of organization, for no book classification can be made consistent throughout with respect to its principles of differentiation. In the Biological

Sciences the principle of organization may follow the genera and species for the classification of natural phenomena. In the geography and travel section the principle may be spatially derived from either natural or political boundaries or a time are the bases of differentiation, in Philosophy the order may be dictated by schools of philosophic thought. In the words of J.H. Shera, "A book classification, then, cannot be a continuous hierarchy of progression from general to specific, but is a series of self-contained orders, loosely assembled into a kind of pseudo-hierarchy by a grand design."  

Third, there is the limitation of inherent incompleteness, for if a book classification is to provide for all knowledge, past, present and future a classification scheme should be provided with infinite hospitality.

Advances in Classification:

The first real break with tradition came at the turn of the present century when Paul Otlet and Henri La Fontaine determined to establish at Brussels a world bibliographic and documentation center, and began their search for an adequate bibliographic instrument that would effectively organize for subject accessibility the mass of diverse materials that they

planned to catalogue. To introduce dimensions into a linear arrangement certain "signs of association" were devised to combine related parts of the schedules in a variety of ways.

A second major advance towards possible solution to the problem of library classification came when S.R. Ranganathan developed the philosophic orientation of his Colon Scheme. He was successful in devising a system of completely interchangeable parts that would admit of almost unlimited collection of related subjects or points of view.

In this Chapter, the present investigator has discussed three general schemes of classification: (1) The Decimal Classification of Dewey (DC) which is the first library classification in the modern sense; (2) The Universal Decimal Classification (UDC) which is originally based on the fifth edition of DC and is the second major scheme to appear. Like, DC, UDC is basically enumerative, but has many synthetic devices grafted on its main core, which give it a great deal of flexibility; (3) The Bibliographic Classification (BC) of H.E. Bliss which is perhaps the last of the great enumerative schemes and though Bliss did include many synthetic tables he does not seem to have appreciated the importance of the principles of analysis and synthesis he himself used. The Colon Classification (CC) of S.R. Ranganathan which is the only completely synthetic general scheme which paved the way for many Faceted Schemes of Modern times has been discussed in detail in the following chapter.
DEWEY DECIMAL CLASSIFICATION SCHEME

Melvil Dewey:

Dewey was born in Adams Center, New York, in 1951. He graduated from Amherst College where he became an Assistant Librarian. As an Amherst student in 1873, Dewey conceived the idea for the classification scheme that would bear his name. In 1876 the DDC was published with the title "A Classification and Subject Index for Cataloguing and Arranging the Books and Pamphlets of a Library." 9

The first edition of 1,000 copies was 44 pages long and included eight pages of introduction, twelve pages of schedules and eighteen pages of index. Although some contemporaries found the new classification too lengthy and subjected it to severe criticism, the DDC was an immediate success and revolutionized library classification. In 1883, he was called to Columbia College where he stayed till 1888 as Librarian and Professor of Library Economy, trying out all his theories. Here, in 1887, he founded and directed the first School of Library Economy. In January 1889, Dewey took up the duties of the Secretary of the Board of Regents of the University of the State of New York and also those of State Librarian at Albany, a city in the New York

State. In the same year, the Library School was removed from Columbia College to Albany and it was named New York State Library School. The Albany period was characterised by a prolonged struggle with the authorities culminating in his premature resignation in September 1905. He then retires to Lake Placid Club in Florida where he stayed until his death on 26th December, 1931. In 1902, Alfred and Syracuse Universities conferred on him Honorary Degrees. An organiser, writer, pamphleteer, and speaker -- in the advocacy of the craft of librarianship -- he was the most energetic and fertilizing personality of his days.

The Decimal Classification - 1876 onwards:

To few men comes the opportunity to complete practically one's personal contribution to a great life's -- work, while still a college undergraduate, not yet livenly -- two years old. That the Decimal Classification was one of Dewey's most important contributions to librarianship hardly needs argument. One needs only to try to visualize a library world that had never received its clarifying influence.

The problem of classing was one over which he had been puzzling for several years before he arrived at his solution; for in many library visits, book classification was one of the first subjects he discussed. In his comments for example, on a visit to New York State Library that he was destined later
to head, he says, "They arrange the books alphabetically, paying no attention to subject."  

Back in the year of its birth, on May 8, 1873, Dewey presented to the Library Committee of Amherst a memorandum -- a document still preserved in the Amherst archives -- outlining his proposed new classification. Summarizing his arguments, Dewey states -

Select the main classes, not to exceed nine and represent each class by one of the (ten digits) nine significant figures. Subdivide each of these main heads into not more than nine subordinate classes, and represent each sub-class by a digit in the first, or tens, decimal place. Thus the sub-classes may be increased in any part of the library without limit; each additional decimal place increasing the minuteness of classification ten-fold.  

Books of a general character, embracing more than one topic as subject would remain in the general class, e.g., "A Dictionary of Science would receive no sub-classification but remain simply with main class number 503. The cipher has its regular zero power, i.e., indicates no classification, for example, 03 would be the class number of a general encyclopedia which covers all the nine classes."

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10 Fremont Rider, Melvil Dewey, Chicago: ALA, 1944, p.27.

11 Melville Dewey, Classification and Subject Index for Cataloguing and Arranging the Books and Pamphlets of a Library, N.Y., Brick Row, 1941.

A photographic facsimile of the Pamphlet in which Dewey, had put out the first version of his scheme for the criticism of his librarian friends.
Books on the same subject are found all together and no growth of special subjects, or limitation of space, or changes of any kind ever separate them. This is of the greatest utility to the library staff and such persons have access to the shelves since they find in one place all the resources of the library on the subject they came to investigate.

When one compares the first and the nineteenth editions of the classification and reviews the phenomena that have contributed to its developments, the one-hundred-years retrospect comprises an impressive vista. It depicts the evolution of growth of knowledge. The scheme developed with the emergence of new ideas, notions and subjects. The classification has grown from an anonymous 44 page pamphlet to a three volume work of some 3,000 pages. The first edition of the DDC was tested by applying it to the collection of books in the Amherst College Library. It was immediately and enthusiastically received by libraries in the United States. Since that time, and especially in recent years, the classification has spread to more than 130 countries throughout the world -- a testimony to its international as well as its domestic utility.
<table>
<thead>
<tr>
<th><strong>A. Survey of Some Formal Characteristics of Dewey Decimal Classification (DDC)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>- Year of first issue</strong></td>
</tr>
<tr>
<td><strong>- Author</strong></td>
</tr>
<tr>
<td><strong>- Number of editions</strong></td>
</tr>
<tr>
<td><strong>- When last edition</strong></td>
</tr>
<tr>
<td><strong>- Editor</strong></td>
</tr>
<tr>
<td><strong>- Number of Volumes, full edition</strong></td>
</tr>
<tr>
<td><strong>- Abridged editions</strong></td>
</tr>
<tr>
<td><strong>- Index</strong></td>
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<tr>
<td><strong>- Kind of notation</strong></td>
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<tr>
<td><strong>- First language</strong></td>
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<tr>
<td><strong>- Translations</strong></td>
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<tr>
<td><strong>- Sponsoring Agency</strong></td>
</tr>
<tr>
<td><strong>- News bulletin</strong></td>
</tr>
</tbody>
</table>

(Notes and decisions on the Decimal Classification) DC & Vol. 4 supplements the 19th edition of the DDC edition 19th. Matters of general interest as well as corrections of errors in Edition 19, clarifications, updating, expansions and new schedules appear in these issues). 

(Contd....)
Decimal Classification Scheme is probably the most popular universal scheme of book classification. It is a hierarchical system using the decimal principle for the subdivision of knowledge, 0-9 and each main class 1-9 consists of ten divisions. The 19th edition has more entries, provisions for more topics and therefore more opportunities to build numbers.

Faceting: There is more recognition of the possibilities of subdividing various subjects according to more than one characteristic, and the order in which the classifier is to consider or combine those characteristics. The International acceptance of the scheme has grown considerably. The BNB adopted DDC ed. 18 in 1971. The Canadian, Indian, South African, and Australian National Bibliographies also Dewey nos.

<table>
<thead>
<tr>
<th>Main Class</th>
<th>Notation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Generalities</td>
<td>000</td>
<td>Sociology Class 301-307, and Political process 324 has been developed.</td>
</tr>
<tr>
<td>2. Philosophy and related disciplines</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>3. Religion</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>4. Social Sciences</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>5. Language</td>
<td>400</td>
<td></td>
</tr>
<tr>
<td>6. Pure Sciences</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>7. Technology (Applied Sciences)</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>8. The Arts</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>9. Literature, Rhetoric General Belles-lettres</td>
<td>800</td>
<td>British Isles. (Area notations 41-42 have been revised to conform to the reorganized local administrative pattern of the U.K.)</td>
</tr>
<tr>
<td>10. Geography and History and their auxiliaries</td>
<td>900</td>
<td>(Contd...)</td>
</tr>
</tbody>
</table>
The DDC notation lends itself readily to subject synthesis or number building, with the benefit of numerous memory aids called mnemonics.

### C. AUXILIARIES:

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table I</td>
<td>Standard Subdivision</td>
<td>The DDC notation lends itself readily to subject synthesis or number building, with the benefit of numerous memory aids called mnemonics.</td>
</tr>
<tr>
<td>Table II</td>
<td>Areas</td>
<td></td>
</tr>
<tr>
<td>Table III</td>
<td>Subdivisions of Individual: Used throughout 810-899 literatures</td>
<td></td>
</tr>
<tr>
<td>Table IV</td>
<td>Subdivision of Individual: Used throughout 420-499. Languages</td>
<td></td>
</tr>
<tr>
<td>Table V</td>
<td>Racial, Ethnic, National Groups</td>
<td></td>
</tr>
<tr>
<td>Table VI</td>
<td>Languages: Tables 5 and 6 are used where numbers were formerly divided like 420-499.</td>
<td></td>
</tr>
<tr>
<td>Table VII</td>
<td>Persons: Used wherever numbers were formerly divided like either 001-999 or 920.1 - 928.9 to designate persons by occupation, social status, ethnic background, etc.</td>
<td></td>
</tr>
</tbody>
</table>
Till edition 18th of Decimal Classification Scheme the DC Editorial Policy Committee while recommending additions, deletions etc. in the existing edition of DC followed a uniform policy which was based on the principles of subject integrity where both the subject content and notation are hierarchical. But the committee always faced the problem at the time of publication of a new edition of the DC of how to reconcile the conflicting requirements of the principle of continuity and integrity of numbers and of keeping pace with evergrowing knowledge.

The most comprehensive change, containing an evolutionary trend, came with the introducing of the five additional auxiliary tables in the 18th edition which were to be used with the schedules. In schedules of Edition 16, the tables (3-7) are:

(3) Subdivisions of Individual Literatures.
(4) Subdivisions of Individual Languages.
(5) Racial, ethnic, national groups.
(6) Language.
(7) Persons.

These tables permitted more detailed analysis through a faceting technique, some part of which were fixed within the schedules themselves, for example, in the 400's and 800's before they were patterned.12

The DDC edition 19th which appeared in 1979 has more topics, and therefore, more opportunities to build numbers. This is a result not only of the greater breadth and depth of knowledge, but also of the growing use of the classification as an efficient method of organizing materials by subject and of retrieving information from machine-readable storage. The determination of how many titles there are in that field or how many may be expected; that is on literary warrant.

Faceting - There is more recognition of the possibilities of subdividing various subjects according to more than one characteristic, and there are more notes establishing the order in which the classifier is to consider or combine those characteristics.

In particular, very detailed step-by-step instructions for building numbers in the 800's have been introduced both into that schedule and into table 3, "sub-divisions of individual literatures," and table 3 has been augmented by supplementary table 3-A, which replaces numerous repetitions of a long array of concepts. For example -

808.81 - 808.88 is collections in specific forms.

808.819 Poetry displaying specific features

Add notations 1-3 from Table 3-A to base number 808.819 e.g., Collection of Poetry about animals is 808.81936.  

Phoenix Schedules and Tables:

 Completely remodelled provisions have been prepared for the following:

 301-307 Sociology has been recast from the former 301, making use in addition of 302-307.

 324 the political process has been recast from the former 324 and 323 and does away with the previous notational bias that favoured United States political parties. Area notations 41-42 have been revised to conform to the re-organised local administrative pattern of the United Kingdom.

 In Table 1, "standard-sub-division" there is a table of president, and 088-089 has a device for arranging any subject by ethnic groups or classes of persons, while 068 replaces class 558.9 as the preferred treatment for Management of enterprises engaged in specific kinds of activities. The use of 08 for collections has been discontinued except in the field of Belles-Letters. In 340, optional provision is made to arrange Law by jurisdiction and also to class law of a favoured jurisdiction in a shorter number. In 900 class there are substantial expansions in the history periods. Interdisciplinary works on geography and history of specific continents, countries localities are classed in 930-990.

 D.C.C. a critical appraisal:

 The Decimal Classification became a sort of international bibliographical language; it made the teaching of classification
in library schools a relatively simple problem, it rendered easily possible all sorts of cooperative cataloguing ventures.

There are many criteria by which we can assess the relative merits of the various classification schemes—order, notation, revision facilities, use in other libraries, bibliographies, card services, and so on. The fundamental concern, however, must be that of subject order; this is surely what classification is about, the grouping of things by degree of likeness, either on the shelves or in the classified catalogue. A scheme whose order fails to meet the requirements of a particular clientele, or which demonstrates little order at all beyond, say, rudimentary grouping by period, geographical, or physical form, is clearly unsatisfactory.  

This basic order in Dewey as in all schemes in general used today rests on a framework of conventional disciplines—literature, history, physics, sociology and so on. These form the main classes. A satisfactory order of this kind requires:

(a) that the major disciplines should be presented;
(b) that they should be given space relative to their size;
(c) that the order of classes should show gradation, bringing related fields into proximity (as far as possible within the confines of linear order); and

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14 P.J. Foskett, op.cit., p.65.
(d) that there should be provision for major changes to meet the inevitable flow of disciplines - i.e., there must be flexibility to allow:

(i) extension of developing discipline;
(ii) reduction of contracting disciplines;
(iii) movement of disciplines or parts of discipline from one section of the scheme to another to express developing relationships.

In addition to the provision of places for simple subjects, each class should also provide clear places for the complex subject which result from the fusion of the elements. For example, not only should there be places for the simple elements Poetry and 19th Century Literature, but also for the complex subject - 18th Century poetry and while there should be a slot for John Donne, another for 20th Century Literature, Poetry and English Literature there should also be a place signifying the complex subject, The influence of John Donne on 19th Century English Poetry.

Next the order of both simple and complex subjects should be systematic and generally acceptable. By systematic we mean that all simple subjects having a common character - whether as in Form or Language or Period, for example, Literature should be grouped together; and that the placing of complex subjects

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should follow a coherent and constant plan. Some guidelines such as the concept of 'decreasing concreteness' should be employed.

In Dewey's class 630 Agriculture, it will be seen that three groups of simple subjects are systematically enumerated: one of processes, one of Injuries and a third covering particular crops, for example,

631.5 Class here cultivation and harvesting of plants and crops.
632 Plant injuries, diseases, pets.
633-635 Specific plant crops.

Complex subjects made up of these elements are also catered for in a similarly systematic fashion. There is thus a clear place for both simple and complex subjects, and an order which is systematic and probably generally acceptable as for example-chronological order of processes, and the collocation of complex subjects under crop. This collocation meets a general need more effectively than otherwise. Thus this section satisfies, literary warrant in its basic provisions and consensus in its order.

Synthesis:

The question which arises is:

Is it necessary to use synthetic devices to achieve the compounding of simple elements to cater for complex subjects found in literature? Theoretically the answer is no! Each of
the complex subjects could have been enumerated in the
schedules. In practice it is impossible. Even schemes
which are predominantly enumerative usually provide synthetic
devices to cater for common form divisions like Space and
Time elements -- for clearly all of these otherwise would
have to be enumerated at more or less every division in the
schedules. Any attempt to enumerate complex subjects is in
practice found to be selective; it would never hope to
encompass the unpredictable multiple relationships found
in literature.

Limitations of an enumerative scheme:

It is likely that the enumeration will be unsystematic,
for example, the harvesting of potatoes may be found under
potatoes, the harvesting of wheat under harvesting. This is
because it becomes increasingly difficult as enumerative
schemes grow for even those responsible for their development
to the principles that underlie them. Thus enumerated schemes
are likely to have the following limitations in the schedules:

(i) Omission of some simple and complex subjects,
duplication of others;

(ii) conflicting principles underlying the place of
complex subjects. 16

16 John Metcalfe, Information indexing and subject
catalogue: alphabetical, classified, coordinate, mechanical,
However, DC has now been able to cater with complex subjects. Hence, number for the harvesting of Potatoes would be:

633.4915
Add to the notation numbers following 631.51-631.57, e.g., harvesting 5.

The Dewey Classification has always incorporated numerous synthetic devices -- Common sub-divisions, Geographical and Historical schedules within the class literature and so on. The 17th edition has a cable of 30 columns enumerating those parts of the schedules where synthesis is used. Recent editions show a marked tendency towards the systematic analysis of principle elements and a provision for synthesis and we can say that hospitality to subjects has increased proportionately.

**Number Building in D.C.**

Number building is the making of classification numbers for subjects and forms out of their numbers or parts of numbers. Dewey along with other and more essential novelties introduced number building; all the classifications since D.C. make use of this. Special developments and application of it began with U.D.C. and hence given the name, synthetic classification. It is from D.C.'s number building method that synthetic classification was developed.¹⁷

¹⁷ John Metcalfe, op.cit.
Any classification number is made out of a fixed and limited number of figures or symbols, e.g., in DC all class numbers are made up of the figures 0-9 and the decimal point; number building means using numbers or parts of numbers in a constant sense. In D.C. the figure combinations 01-09 at the end of numbers have constant or mnemonic meaning with few exceptions, and any extension of 016 bibliography and some other number is always a whole number from elsewhere in the classification e.g., 016.6 Bibliography of Useful Arts and 016.621384 is Bibliography of Wireless-Wireless, being 621.384.

Example of Facet Analysis.

**Agro-economics:**

Agro-economics is an interdisciplinary class: In the Class Number 338.17311 is a combination of a whole number as were as part of another numbers.

Economics of agricultural products is 338.17, extended by extensions of Class 631. As 633.11 is Wheat; 338.17311 is the "Economics of Wheat Production".

The figures by themselves do not have constant meaning; if they had then only ten subjects could be numbered by 0-9. In certain examples 5 means Italy and Italian, while as the first figure in a number it stands for science. In combinations 3 means dictionary, 503 is Dictionary of Science. 405.03
The constant use of some figure combinations results in their meaning being remembered, they become mnemonics. Dewey introduced the idea and made much use of them.

From the standpoint of flexibility, Dewey Decimal Classification has been charged for making small use of synthesis. D.C. is so-called 'Logical' system; that is to say that its structure is based on the traditional logical method of division by beginning with a Main Class or groups and resolving it into a number of species by the addition, one at a time, of different characteristics. However, it may be easy to locate such terms as 'society' or 'The Family', or Prostitution, but a classification scheme has to express relationships between entities, as well as the relationships and the entities themselves.\(^\text{16}\)

A subject, 'The influence of hereditary factors in the psychology of delinquent children'.

Example –

The number for influence of hereditary factors in the psychology of delinquent children will be:

\[^{16}\text{D.J. Foskett, Classification and Indexing in the social sciences. 2nd ed. London: Butterworths, 1977, p.67.}\]
155.453
155
.4
5
3
=155.453
or 155.7

Differential and genetic psychology
Child psychology
Exceptional Children
Delinquent and problem students (from 371.94)

Evolutional psychology which is a general
aspect and there is no provision for synthesis.

The scheme recognises the existence of the various
facets of the subject namely (1) Psychology, (2) Hereditary
factors (3) Delinquent children.

Number for Psychology of delinquent children is
155.453, and for Hereditary factors is 573.2 (genetics of
man).

But the scheme fails to show the relationship expressed
here as 'influence'. 19

There is also likelihood of the same book going at
either 155.453 or 573.2 if classified by two different
classifiers.

However, a provision for synthesis does occur for the
schedule of exceptional types of children from Education
371.9 which may be used in the Psychology class at 155.45.

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19 Anthony Croghan, The Dewey Decimal Classification
and its eighteenth edition. In Library Association Record,
Vol. 74, pp.120-21, 1972.
An example of Analysis and Synthesis in DDC Number may be illustrated with the help of the following example:

Diseases caused to Peanuts from air pollution and radiation will be

Example:

633.368919
633  Field crops
   • 3  Legumes and other forage crops
   68  Peanuts
   • 9  Injuries, diseases, pests (add as instructed under 633-635)
   19  From air pollution and radiation (add to 9 number following 632.1 - 632.9)

= 633.368919

19th Edition - Critical Review:

"Despite its 3387 new entries, despite new schedules for energy and political science, despite a new treatment for sociology ..., despite improved relocations and new area schedules for the United Kingdom and despite increased opportunities for synthesizing compound subjects, the nineteenth edition of DDC remains antique in conception, confused in

principle, cumbersome in operation and idiosyncratic in detail."

The DDC compilers have taken seriously the modern claim of classificationists for the utility of classification for retrieval purposes, i.e., the Organization of subject files. As a result the nineteenth edition has certain modern features introduced to improve the quality of specification and flexibility. However, the results are not always satisfying. Compound subjects produce lengthy class numbers, e.g., the glass directory and buyer's guide will have the number 666.10580688.

Relationships so important in the Social Sciences are disregarded for example. A comparative economic analysis of East and West cannot be specified.

UNIVERSAL DECIMAL CLASSIFICATION

Basic Concepts:

U.D.C. is a universal scheme of classification in two senses: firstly, it is a general classification covering all knowledge, not as a patchwork of isolated self-sufficient specialist groupings but as an integrated pattern of correlated

secondly, it aims to provide subject descriptions of the utmost precision, whether such precision demands coordination of terms from within one subject field or from quite distinct fields.

Precision in subject description is sought by an analysis of ideas, seen most clearly in the separation of auxiliary schedules, both common and special; from the other facets enumerated under each class, in order to produce relatively elementary concepts and the provision of synthetic devices whereby 'compounds' may be formed by coordination.23

It aims to provide a practical system for retrieving information in which the file order of subjects is considered to be of less importance than the provision for detail in specification (achieved by exhaustive enumeration of terms combined with notational synthesis). Order of subjects is still regarded as important, since this is what marks off a classified system from any other, i.e., related concepts are systematically brought together and their connections displayed in a systematic arrangement.


Order of Classes:

So far as the order of classes is concerned U.D.C. formally accepts certain traditional principles; notably the general preceding the special, mutually exclusive classes, collocation of cognate classes, and consistency of approach.

Precise facet formulae:

However, it fails to provide a precise facet formulae in each class, or to recognize the principle of inversion whereby general before special is maintained and so these theoretical principles are imperfectly implemented in practice.

Universality:

The term 'universal' bears three meanings as applied to U.D.C. (1) it is intended for all countries, embodies all knowledge, and most important allows any combination of concepts from any subject. By the transference of all national and racial factors to separate common facets, the classification of subjects is unimpeded by any bias to the needs of one particular nation. Nevertheless, it is undeniable that the viewpoint is a western one. It neglects relatively, non-Christian religious systems, and non-Western philosophy, while in the social sciences the traditional political and economic systems of the west are used as the basis for classification.

Its universality also lies in the fact that it is able to specify any subject. This is the result of combining
exhaustive enumeration in the schedules with a large apparatus for synthesis or co-ordination. The use of the synthetic devices especially the colon, allows a high degree of coordination of elementary concepts in different permutations, thereby minimizing the rigidity of a pre-coordinate system.  

Origins and Development of UDC:

The Universal Decimal Classification may be regarded as the first synthetic scheme to be developed. It began as a French translation of the DDC, later became an adaptation. Although UDC still has a basic enumeration of subjects (like DDC), but in addition it has an apparatus of notational devices which can be used to create one complex description by assembling several components of notation from any part of the scheme or from any of a dozen or so auxiliary tables. That is the essence of synthetic classification.

In the last quarter of the 19th century there was an increasing concern for the problems of documentation. In the early 1890s Paul Otlet and Henri La Fontaine, in Belgium, proposed a universal index to recorded knowledge which must include non-book materials, ephemera as well as conventional material. In 1895 the First International Conference on

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Bibliography approved their plans and established the Institut International de Bibliographe (IIB). Paul Otlet and La Fontaine looked to the DDC as the basis of a truly international scheme. DDC was based on the idea of subject description; it had a notation that was truly international, and its internal organization of fractional decimal division offered infinite hospitality. "The often implicit and sometimes explicit pattern in the Decimal Classification of entity followed by activity offered very great potentiality for a synthetic scheme." 

Otlet and La Fontaine negotiated with Dewey to use his scheme for the IIB's index. The adapted scheme was first published in 1905 by the IIB as the Manuel du repertoire universel bibliographique and came to be known as the "Brussels Classification". Between 1927 and 1933 four volumes of the scheme were published in French, entitled Classification Decimale Universelle. German and English editions began in 1934. The German edition was completed in 1952. But the publication of full English edition was still incomplete in 1973. Revision of the French and the German full editions were begun in 1960s, and new editions were begun in Japanese and Spanish.

26 David Batty, op.cit., p.126.
27 Ibid., p.127.
Probably the greatest impact of UDC has been through the abridged editions now published in some 16 languages. The first English abridged edition published by British Standards Institution came in 1948, revised second edition appeared in 1957 and the third revised edition was published in 1961. A trilingual edition, in English, French and German, was published in 1958; its supplement issued in 1968 is a supplement to the latest English abridged edition of 1961.

Organizational Structure of UDC:

In 1931 the IIB became the Institut International de Documentation (IID) and in 1937 changed its name to the Federation International de Documentation (FID). In 1929 Donker Duyvis of the Dutch Patent Office, became secretary of the IIB and the offices were shifted to the Hague. From these offices are conducted international coordination of the revision and development of the UDC.

Synthetic Principle:

The synthetic principle is one of the main reasons for the widespread use of UDC in preference to other systems. It extended the use of common tables, geographical subdivisions and viewpoints, all of which were established to different degrees in previous classifications, and added the 'colon principle' whereby every part of the classification became divisible by every other part. This, with the growing complexity of knowledge, was an invaluable invention.
### Table 2.2

**Some Formal Characteristics of the Universal Decimal Classification**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of first issue</td>
<td>1897/1905</td>
</tr>
<tr>
<td>Number of editions</td>
<td>8 international</td>
</tr>
<tr>
<td>When last edition</td>
<td>1964</td>
</tr>
<tr>
<td>Number of volumes, full edition</td>
<td>Four (includes to issue in 8/9 volumes)</td>
</tr>
<tr>
<td>Abridged editions</td>
<td>Published in 16 languages. 3rd revised English Abridged edition was published in 1961.</td>
</tr>
<tr>
<td>Notation</td>
<td>Numbers (auxiliary notation in which are set out connecting signs and the common auxiliaries (a) to (i), special -.. and 0 subdivision (k).)</td>
</tr>
<tr>
<td>Translations</td>
<td>English/Japanese/Spanish</td>
</tr>
<tr>
<td>First Language</td>
<td>French/German</td>
</tr>
<tr>
<td>Sponsoring Agency</td>
<td>Federation International de Documentation (FID), The Hague.</td>
</tr>
<tr>
<td>News Bulletin</td>
<td>Central Classification Committee issues P-notes which are cumulated in Extensions and Corrections to the UDC</td>
</tr>
<tr>
<td>Number of Users</td>
<td>100,000, including specialized libraries and information centres, journals, indexing and abstracting services. (In Russia, it is used in scientific and technical libraries).</td>
</tr>
</tbody>
</table>

(Contd..)

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Universal Decimal Classification is an almost faceted scheme for classification. It provides a schedule of compound classes. In addition a few schedules of common isolates and special isolates have also been given.

The abridged edition consists of main tables, several auxiliary tables and an alphabetical index. Tables of auxiliaries include distinctive schedules of common isolates. Main tables also contain a few schedules of special isolates. These special isolates are mixed with different kinds of isolates.

It has provision for facet analysis. Phase analysis is provided but at times the same device is also used for the facet analysis.\textsuperscript{30}

\textsuperscript{30}Krishan Kumar, \textit{op.cit.}, Table 25.1.
<table>
<thead>
<tr>
<th>Class</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalities</td>
<td>0</td>
</tr>
<tr>
<td>Philosophy</td>
<td>1</td>
</tr>
<tr>
<td>Religion Theology</td>
<td>2</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>3</td>
</tr>
<tr>
<td>Philology, Linguistics Languages</td>
<td>4</td>
</tr>
<tr>
<td>Mathematics and Natural Sciences</td>
<td>5</td>
</tr>
<tr>
<td>Applied Sciences, Medicine Technology</td>
<td>6</td>
</tr>
<tr>
<td>The Arts, Recreation Entertainment, Sport</td>
<td>7</td>
</tr>
<tr>
<td>Literature, Belles-Lettres</td>
<td>8</td>
</tr>
<tr>
<td>Geography, Biography, History</td>
<td>9</td>
</tr>
</tbody>
</table>

The order of the main classes is the same as DDC.

**PART -B: Kind and Number of General Auxiliaries**

<table>
<thead>
<tr>
<th>Auxiliary</th>
<th>Notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>=</td>
</tr>
<tr>
<td>Form/Kinds of Documents</td>
<td>(0 ...)</td>
</tr>
<tr>
<td>Place</td>
<td>1/9</td>
</tr>
<tr>
<td>Race, Nationality</td>
<td>(= ...)</td>
</tr>
<tr>
<td>Time</td>
<td>&quot;...&quot;</td>
</tr>
<tr>
<td>Point of view persons</td>
<td>.00 ...</td>
</tr>
<tr>
<td>Alphabetical and non-UDC numerical specification</td>
<td>A/Z I, II, III, etc.</td>
</tr>
<tr>
<td>Special Auxiliary subdivision</td>
<td>-01-9, Cand'...</td>
</tr>
</tbody>
</table>
In the words of Miss Barbara Kyle, "If we now criticize the UDC, it is because its very success encouraged new thinking and opened up the possibility of systematizing some of the haphazard usage of its invention. For one reason or another, the UDC has not been able to keep up with these developments. There is therefore a growing body of opinion which supports the view that for new libraries and bibliographical information services it might be quicker, more efficient and more economical to start again rather than wait for a revised UDC."31

However, is the UDC sufficiently synthetic? Many of the criticisms32 levelled at the UDC at the intellectual level are concerned with its hierarchical structure in the main classes. Common subdivisions, special analytical divisions and the use of the colon are not enough to make clear the interrelationships in modern knowledge. Further common subdivisions and further special analytical divisions for more schedules might help, but probably would not go far enough.33


UDC has attempted in many ways to increase the flexibility of decimal notations; it has, for example, shown great interest in Ranganathan's idea of the Octave Device to secure greater hospitality in array. The scheme also employs what has been called the Centesimal Device to lengthen arrays where nine divisions are quite inadequate. This means that instead of using the digits 1-9 to represent co-ordinate topics the digits 11-99 must be adopted for this purpose.

Synthesis and Mnemonics:

The scheme has a most powerful synthetic apparatus available in a series of auxiliary tables which may be regarded as a detailed development of the notions contained in DC's standard sub-divisions and area table. These auxiliary tables are supported by a series of signs of combination and abbreviation. The full range of the synthetic devices is as follows:
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Plus sign</td>
<td>Document deals with two topics</td>
</tr>
<tr>
<td>/</td>
<td>to</td>
<td>Document covers several consecutive topics in the scheme</td>
</tr>
<tr>
<td>0/9</td>
<td>Plain UDC number</td>
<td>Numbers in Main Tables</td>
</tr>
<tr>
<td>:</td>
<td>Colon</td>
<td>Document deals with the relationship between two subject fields.</td>
</tr>
<tr>
<td>( )</td>
<td>Square brackets</td>
<td>Similar to the use of the Colon sign</td>
</tr>
<tr>
<td>=</td>
<td>Equals sign</td>
<td>Indicates the language in which a document appears</td>
</tr>
<tr>
<td>(o)</td>
<td>Brackets o</td>
<td>Form sub-divisions</td>
</tr>
<tr>
<td>(1/9)</td>
<td>Parenthesis</td>
<td>Covers place sub-divisions</td>
</tr>
<tr>
<td>(=)</td>
<td>Equals sign within parenthesis</td>
<td>Covers sub-divisions denoting race</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>Inverted Commas</td>
<td>Indicates time sub-divisions</td>
</tr>
<tr>
<td>A-2</td>
<td>Alphabetical order</td>
<td>To be used when needed for final arrangement</td>
</tr>
<tr>
<td>.00</td>
<td>Point double zero</td>
<td>Common auxiliary division of standpoints and points of view</td>
</tr>
<tr>
<td>-</td>
<td>Hyphen</td>
<td>Used in certain parts of the UDC to introduce special analytical sub-divisions.</td>
</tr>
<tr>
<td>.0</td>
<td>Point zero</td>
<td></td>
</tr>
<tr>
<td>'</td>
<td>Apostrophe</td>
<td></td>
</tr>
</tbody>
</table>

Filing or listing order of compound UDC Numbers:

For the 'vertical' filing or listing order of series of UDC numbered items, the basic principle (as for the whole classification) is the development from the general to the particular, that is, the less restrictive before the more restrictive numbers. However, the UDC uses the colon as both phase would file where UDC places the colon, but a facet should be placed immediately before the next explicit subdivision, at the bottom of the list. Secondly, it files place before time.

Auxiliary Tables and Compound Numbers in UDC:

Here is a simple number 675, for Leather and the leather industry, with all the signs of association and auxiliary tables in the 'vertical', "filing or listing order of compound UDC numbers."

Example:

(1) 675 + 678 Leather and rubber
(2) 675/678 Leather, paper, textiles, rubber


36 John Melcalfe, U.D.C. and Synthetic Classification. In Subject Classifying and Indexing of Libraries and Literature, p.144.
(3) 675.93 Leather in history
(4) 675=27 Leather industry instruction, or leather-study and teaching
(5) 675 = 20 Leather, works on/in English
(6) 675(021) Leather, a manual
(7) 675(4½) Leather in France
(8) 675 (=927) Leather among the Arabs
(9) 675"18" Leather in the 19th century
(10) 675 Smith leather, Smith manufacture
(11) 675.007 Leather industry, personnel
(12) 675-78 Leather industry-safety devices
(13) 675-02 Leather dressing.

(1) The plus sign, joins two or more non-consecutive UDC numbers for subjects treated in the same document, the subjects being "commonly associated concepts", but not treated in relation or as affecting each other in the document. "Filing difficulties are raised by 675+677+678, which seems to reflect the earlier and discarded idea of specifying the document rather than classifying it according to its subjects." The compound is of two, or more, main class simple numbers, and that it could be filed in an order of these numbers in any permutation or reversal, 677+675+678, and 678+677+675. But this is not done with this sign; when compounds are to be permuted or reversed the colon sign of (3) is invariably used.

(2) The stroke / indicates consecutive simple numbers in their numerical order from one before the sign to one after it, e.g., 675/678 for a document on leather, paper, textiles.
and rubber. This device has more use than that of addition. Suppose a book on birds 636.6, dogs 636.7, cats 636.8, other animals. Lets 636.9; if it were classified generally as 636 Animal Husbandry it would be lost, whereas 636.6/9 groups its subjects in place.

(3) The colon sign, :, is used not only for a relation of two things such as religion and science, 2:5 or 5:2 as itself a subject, but also for any relation of two or more 'concepts' as expressed by UDC nos., whenever the compound is to be reversed for added entry, so it is used as an alternative or substitute for at least (6) and (11) to (13).

(4) The square brackets sign, may be used, as an alternative to the Colon, "when the relationship involves a subordinate concept for which no separate entry is required by reversal".

(5) The equal sign, by itself "serves to designate with numbers, "the languages or linguistic form of any subject denoted by a main UDC number. The table is "recommended only for very detailed sub-division", and where language is important. 22.05 = 30 Bible in German. 6(03) = 20, Medical encyclopaedia in English.

(6) The round brackets sign with 0, (0 . . . .), is used for the table which is called form and is nearest to DC's form nos. (091) historical presentation of a subject History of
Mathematics 51(091) 51.93 would mean the subject in relation to political and social history.

(7) The round brackets sign without 0 ( ), is used for common auxiliaries of place, which are a place table used where in DC its history class extensions are used. English agriculture is 63 (420) which in DC would be 630.942.

(8) The round brackets sign with the equal sign, is used for common auxiliaries of race and nationality. With some variations for races without a country the history extensions or place numbers are used (= 944) Australian aboriginals, so Crocodile hunting in Australia would be 639.1(94), but Crocodile hunting by Australian aborigines would be 639.1(994).

(9) The inverted commas sign, with some special figures and with actual date figures is used for the common auxiliaries of time. These are used throughout including History, in which the the Norman period in English history is 942"1066/1154" and not 942.02 as in D.C.

**UDC a Critical Appraisal:**

DC has influenced classification thinking for more than those who reject them. They produced the essential method of all later classification schemes; they produced UDC in particular and current ideas of the chain analysis of class numbers for indexing purposes derive largely from an inessential and in some respects a bad feature of DC, the close step by step
development in the hierarchies of its class and its notation.

UDC generated the ideas of synthetic classification now current, right from Otlet's ideas of bibliographical notation as a universal code or language come loose talk of class numbers as code numbers as in BNB, ideas of class numbers as a classificatory language to be used even as a basis for the headings and references of the dictionary catalogue and as a means of perpetuating class, by providing basic, or nuclear or elemental terms out of which all others can be forever compounded.

Principally representative of this neosynthetic classification is the theory and practice of Ranganathan in India and his disciples in Great Britain, expressing themselves in BNB and in this theory and practice there appear to be two principal developments or modifications of Otlet's original synthetic classification.

DC mnemonic or constant or standard form numbers are developed into UDC's auxiliary tables and especially its analytical subdivisions, are still further into standard parts, the facets and foci of Ranganathan's C.C. out of which the main classification numbers for all subjects, past, present and future, are to be built, like chemical compounds out of chemical elements, the physical atom out of its nuclei, and toy models out of a child's building set.
Compound classification numbers are to specify the document or as it has been put as late as 1958 by Wells, they are to be co-extensive with the subjects of the works catalogued. Ranganathan supported by Vickery in England said that what should be aimed at is translating into ordinal numbers, the entire thought content of a book — all its foci, all its crisscross of subjects and forms and all its interlacings — fully and literally.

While commenting on the general schemes of Classification, D.J. Foskett states -

The main new feature (of U.D.C.) from the viewpoint of information retrieval, is the systematic attempt to cater for synthesis of complex subjects by means of series of Auxiliary Tables, which include tables for Geographical and Chronological sub-division but also go much further; they are identified by the use of arbitrary signs such as +, /, ( ), and so on, as well as .00 and .0. The disadvantage of these, of course, is that they do not have an accepted position in the sequence of numerals or letters, and their sequence has therefore to be laid down, and either memorised or consulted whenever the file is used. But the Auxiliary Tables certainly enable UDC to cope with even the most complex subjects, though in a somewhat cumbersome way. The most used symbol is the colon, which is the sign of relation, and does not actually have a Table as such, since it can be used to join any two (or more) numbers from the scheme.

37 Indian Librarian, June 1958.
39 D.J. Foskett, op. cit., pp. 70-71.
Thus, the example given earlier from DC, of 'The influence of hereditary factors in the psychology of delinquent children', is dealt with in UDC by the formula $ATB$, where $A$ is 'delinquent children', $B$ is 'hereditary factors' and $r$ is the symbol of relation, the colon. The colon device has often been claimed to be the complete answer to the problem of expressing relations by means of synthesis, but it is, of course, no more than a beginning, since the same sign is used for all manner of different relations, influence, comparison, cause and effect, and so on, and there is therefore no means of distinguishing between these. Thus, in the index cards issued by the Centre d'Information de Documentation Sociale et Economique Africaine, in Brussels, we find subjects such as these:

1. Mining research in Spanish Sahara 338:622 (661)
   where 338 is Production, 622 is Mining and (66) is Sahara (and French West Africa); and

2. Economic regulations affecting the cocoa trade on Ivory Coast 351.824.5: 633.74 (666.8) where 351.824.5 is Trade, 633.74 is the cocoa industry and (666.8) is the Ivory Coast.

Clearly, in these examples the colon sign stands for two different meanings, thus introducing homonyms into what is in effect an artificial language. Such a procedure inevitably brings ambiguity, always undesirable, and avoidable if the necessity of distinguishing between different relations is recognised by the use of
different notational symbols. Moreover, although the ability to synthesise as many numbers as required undoubtedly enables the scheme to achieve precise specification, the basic structure, taken from DC, still prevents the separation of categories in the scheme, and their combination as the literature requires.

The wide acceptance of the UDC, particularly on the Continent of Europe, testifies rather to the power of the new devices for synthesis than to the intrinsic qualities of the scheme itself. The official view of the FID and the British Standards Institution is that the UDC can be brought up to date and equipped with devices able to cope with modern literature in a manner acceptable to specialists.

THE BIBLIOGRAPHIC CLASSIFICATION

Henry Evelyn Bliss: A Biographical Sketch

Unlike Dewey, who published his scheme within a few years, Henry Evelyn Bliss (1870-1955) spent some thirty years developing his ideas on bibliographical classification. He was for many years on the library staff of the college of the City of New York. His major work, A Bibliographic Classification, was published in four volumes between 1940

40 D. J. Foskett, op. cit., p. 161.

and 1953, a one-volume outline of his scheme, entitled, "A system of Bibliographic Classification", appeared in 1935. The scheme is being revised under the editorship of Jack Mills sponsored by the Bliss Classification Association.

Bliss considered that most important part of a classification scheme was its order of basic classes, and BC demonstrates this emphasis very clearly. The three major principles on which Bliss based his order of classes:

1. Collocation of related subjects;
2. Subordination of special to general; and
3. Gradation by speciality.

While in theory these ideas are sound, and are in accordance with the philosophical systems of such writers as Comte, in practice their application is not so simple, and in Bibliographic Classification sometimes leads to unsatisfactory results, for example the separation of Science from Useful Arts by the whole of the Social Sciences.

Although Bliss recognized the need for some forms of synthesis, he was hostile to the idea of complete analysis and synthesis put forward by Ranganathan.

The second edition of Bliss Bibliographic Classification was published by Bliss Classification Association in
The Bliss Classification Association was founded in 1967, a non-profit body to promote the use and development of the Bibliographic Classification. A regular Bulletin is published annually which provides a maintenance service of additions, amendments, etc., as well as forum of the discussion of problems of classification in relation to the scheme.

Bliss's objective was essentially a practical one. In his 1952 Preface Bliss wrote: "In so far as knowledge is developmental so shall classification be developmental." He made a deliberate attempt to find a scientific basis for his sequence of main classes. He had made an extensive

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43 Ibid., p.3.
study of the history of classifications of the sciences, and his outline may broadly be summarised as Sciences, Social Science, Humanities. Thus, the science of Man begin with Class B Anthropology and Medicine, and go on to I Psychology, J Education, K Sociology, L-O History, Q Social Welfare, R Political Science, S Law, T Economics. The terminology is naturally more up to date than that of other schemes, since the full scheme was first published from 1940 to 1953, but once again we find that some important process terms such as 'Social Change' and 'Stratification' are missing from both schedules of index. As can be seen, the order collocates subjects used together very much better than the other schemes, and there is in addition a much more liberal provision of references from one part to another. For example, at IPC Memory and learning, there is a 'See also' reference to JE in Education. An example of alternative collocation is that of the Law of Special subjects, which can be placed either with the subject itself or in the main class for Law, between SL and SS.

The important principle of composite specification is based on the Systematic Auxiliary Schedules, which consists of lists of terms that may be used to subdivide more than one term in the scheme. Most of them use a notation of

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\[\text{Arthur Maltby,\,(ed.). Classification in 1970s. A Discussion of Development and Prospects for the Major Schemes.}
\[\text{Bingley, 1972.}\]
capital letters, like the scheme itself, but are separated from the main subject number by a comma. Drafts for several social subjects are complete, including Statistics, Education, History, Social Welfare, and Political Science. Extensive use has been made of facet analysis for a basis, and the draft revisions seem to have achieved striking success in incorporating this type of structure without too much disturbance of the existing schedules and notation. In some cases alternative schedules are being provided for present users who do not wish to make too many changes — one of the most difficult problems facing the editors of any such revisions. The facility for synthesis is retained, by simple combination of national symbols retroactively — that is, from the last schedules backwards. The primary facet, Educands and Schools, comes at the end at JL: Primary Education in JM, and the first direct sub-divisions begins at JMM, JMN, etc. All the terms preceding these in the schedule can be used as sub-divisions simply by adding the appropriate notation:

(1) JMA 'Aims and objectives of primary education', where AE is taken from facet JA Principles and Philosophy of Education, in which JAB is Aims and Objectives.

^D. J. Foskett, op. cit., p. 76.
(ii) JMC Administration of primary schools, where C is taken from facet JC Organisation and Administration of Schools.

(iii) JMK Curriculum in primary schools, where K is taken from facet JK Curriculumm.

This notational device, first proposed by E.J. Coates,\(^46\) gives great flexibility with relative brevity; the result is that, within a given facet, the first arrays of sub-divisions can be worked out as required by the literature and will give a sequence parallel to that of the whole classification.

**Synthesis** is achieved by using the whole classification to divide certain subjects. In JK Curriculum the first set of sub-divisions is specific to JK, but after JKM synthesis is allowed. Thus, Main class B is Physics; JKN is Teaching Physics, divided like Class B. These forms of synthesis give the classifier greatly improved autonomy for specifying complex subjects in a post-coordinate manner as required by the literature, and the new addition of BC,\(^47\) represents real advance over the old, while preserving much of Bliss's own original thinking.


Mills has well said that it was 'basically an enumerative system. It might, without exaggeration, be called the fine flower of that species, his team's contribution will certainly give it a strong claim to be regarded as a completely new and modern general scheme. It is in use in a number of libraries already, notably in Schools and Institutes of Education and other school libraries. A Bliss Classification Bulletin has appeared regularly, and if the revision can be based on an institution, instead of in the hands of one mortal, the scheme looks very attractive for future users; in any case, it can certainly be agreed that Bliss set a new standard of Scholarship in the construction of such schemes, and ranks with Dewey in the value of his contribution to the science of Classification.

**Broad Facets in Bibliographic Classification**

Each class of Bibliographic Classification has its vocabulary organized in the first place into broad facets. For example, Class J Education recognizes such facets as Educands (per persons taught), Subjects taught, Method of teaching, etc. Class P Religion recognizes such facets as Religious systems, Religious practices, Systematic theology, etc. Class C Chemistry recognizes such facets as Substances,
Components and structures of substances, Reactions, Operations on substances (i.e., practical and analytical Chemistry', etc. These facets reflect various relations in the class; e.g., they may reflect the relationship of an End-product in the class (for example, educands are the 'end-product' in Education); or a Part (e.g., atoms, electrons, surfaces, etc. are parts of a chemical substances; legislatures, executives, parties, etc. are parts of a political system); or an Action (e.g., analysis is an action performed on a substance, teaching is an action performed on an educand), or an Agent of actions or processes (e.g., agricultural implements, building etc. are agents of agricultural operations; civil services, etc. are agents of operations in public administration). Every term in the vocabulary of every class is assigned to an explicitly named facet.49

Arrays:

Within every facet of every class, the terms are organised into separate arrays, each of which reflects one specific principle of division, i.e., one which generates mutually exclusive classes. For example, in the Educands facet of Education persons by age (child, adolescent ...), are distinguished from persons by physical disability (deaf....)

49 Bliss Bibliographic Classification. 2nd ed. op. cit., p.56.
or by sex. Or within the facet of Place (a 'common' facet which may be applied to any subject of need be) are found arrays based on political unit (Denmark, Sweden, USSR...), altitude (highland, lowland ...), latitude (tropics, temperate zones...), military groupings (NATO...) and so on. Because the classes within an array are mutually exclusive, no intersection is possible -- e.g., one will never need to recognize a class such as high low land, or teenagers aged 5-11.

Citation Order:

Every class has an explicit citation order covering compounds of terms, both from different facets and from different arrays. The citation order between facets observes the 'standard' citation order: e.g., in Chemistry (Class C) the primary facet (the first-cited one) is Types of substances, the secondary facet is Parts and structures of Substances. The tertiary facet is Processes and reactions, the fourth is Operations, and so on. In Biology, the primary facet is Types of organism, the secondary facet is Parts, organs and systems within organisms, the tertiary facet is the processes facet (giving concepts such as Physiology, Pathology, Developmental Biology ...) and the last is an Operations and Agents facet of investigation actions and their instruments, etc.

"This reflects consistent application of principles of division which first divides the initial main class into its
products or whole systems studied, then successively into their sub-systems of parts, their processes or internal behaviour, the operations performed in or on them. Agents of these actions and so on.\textsuperscript{50}

**Hierarchical Relations:**

These are shown in the filing order by indentation within each facet. Since there is no subordination of one facet to another (except in the case of compound classes, which are not enumerated in the BC) all facets begin in alignment; for example,

- JB Educational administration
- JF Educational performance
- JPB Measurement and testing
- JFC Measurement
- JFD Tests, in general
- JFE Construction of tests and scales

Because the notation is purely ordinal and does not necessarily express the hierarchical relations between the classes it represents, the symbolism of indentation to indicate class-inclusion (subordination) is strictly observed.

\textsuperscript{50}Bliss Bibliographic, p.38.
Alternatives within main classes:

In Class J Education the preferred citation order:
Persons taught, or Subject taught - Method of teaching. Alternatives are provided whereby the Subject taught, or the Method of teaching, is made the primary facet. In Class W/Y Literature extensive alternatives are offered in the citation order as between Period, Form and Author and on the question whether works about a writer should file with the texts of the works by that writer. Similar alternatives are offered in Class P Religion, where texts of the Bible for example, may be arranged in different ways relative to the treatment of works about them. An example of a very specific alternative in citation order for one array is found in Class Q Social Welfare where documents on fostered or adopted children with special needs (e.g., handicapped) may be subordinated to the special need (in OM) or to the welfare action of fostering (QLL) or adoption (QLM).

An example of simple alternative location, without affecting the internal arrangement of the class concerned, is to locate Islam at PV in its correct position in the chronological order of major religions or at PK in collocation with other Eastern religions and with Judaism.
Notation:  

The BC notation consists of capital letters A-Z and arabic numerals 1/9, the latter having a filing order, lower than the former - i.e., numerals file before letters and lower case letters a-z are used fairly often. At the level of broad order, the numerals are used for the Generalia classes (of disciplines and of phenomena) and the letters for the disciplines and subdisciplines of phenomena) and the letters for the disciplines and subdisciplines themselves. Within each class, the numerals usually introduce subsidiary and common facets and the letters both subsidiary and major facets.

If a policy of multiple, subject entry is followed in the catalogue a hyphen (-) is also used to link the component classmarks. Its filing value lies after numerals and before letters. The hospitality of the notation is achieved by the radix fraction principle, the extensive use of the principle of faceted notation (i.e., using distinctive symbols to show the conjunction of different facets, thereby allowing the independent expansion of each facet).  

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52 Jack Mills, Bibliographic Classification, op. cit., p. 375.
or synthesis is achieved by a number of systematic schedules which are of two kinds — general, i.e., applicable to any class and special-applicable to limited classes.

Functions:

It's a purely ordinal notation; and makes no claim to express hierarchical relations. It concentrates on maintaining the carefully determined sequence of classes with classmarks of maximum brevity and simplicity. Although it expresses hierarchy to a limited degree, but relies on the careful indentation and display in the schedules to convey clearly to the indexer the full hierarchical relations involved.

Qualities of the BC Notation:

A major quality is its ability to show compound classes, compounds may arise between elements from different facets, from different arrays in the same facet, or between different (main) classes.

To meet the problem fully, BC provides a faceted, synthetic notation. The schedules do not usually attempt to enumerate compound classes within a class but rely on the notation to represent accurately all possible compound classes by synthesis. This means that the elements from the different facets and arrays making up the index description which summarizes
the information content of a document are brought together in the order prescribed by the rules for citation order.\textsuperscript{54}

For example, in \textit{Education (Class J)}:

(i) Audio-visual aids is JUN.

(ii) Biology (in the curriculum) is JKQ.

(iii) Secondary education is JN.

and from these elements compound classes may be built (synthesized).

\begin{center}
\begin{tabular}{ll}
Biology teaching & - Audio-visual aids JAQ JN \\
Secondary education & - Audio-visual aids JNJ N \\
Secondary education & - Biology teaching-Audio-visual aids JNK QJN \\
\end{tabular}
\end{center}

It may be noted here that virtually all classifications, general or special, use some degree of synthesis. The BC takes the process to a logical and practical conclusion.

The chief method used in \textit{synthesis} is that of retroactive notation, e.g., in Education (Class J) the class Secondary education begins at JN; its first enumerated subclasses (i.e., the subclasses peculiar to the class in question, secondary education, and whose notation is provided ready-made and not built by synthesis) are;

\begin{itemize}
  \item JNM For students with minimum schooling.
  \item JNN Lower school, 11-13 years.
\end{itemize}

\textsuperscript{54}\textit{Bibliographic Classification}. 2nd ed. \textit{op.cit.}, pp.58-59.
As a result, in view of the precision with which it can represent very specific subjects, the BC notation is exceptionally brief.

The synthetic quality, implying the repetitive use of the same symbols for certain concepts gives a slight mnemonic quality to many classmarks. This is particularly the case where Common sub-divisions are used. The coincidence of the initial or last component letter in a classmark being the initial of the name of the class (e.g., PHM Mithraism; C Chemistry; UA Agriculture) gives a mildly mnemonic quality to a few specific classes.

The Alphabetical Index:

Each separately published class or set of classes in BC has its own A/Z index and it is planned to produce a consolidated version when all classes have been published. These indexes are all constructed by chain procedure which is best explained by a practical demonstration. The following are extracted from a section of schedule in Class P Religion and show the full hierarchy whereby the class Obedience is arrived at:

PD Practice of religion, religious activities, devotional religion.

PE Types of religious activity
From this are derived a number of entries for the A/Z index. Each line (representing a class in the hierarchy) is considered as a candidate for a key word, i.e., a name providing access to a user by being filed in the front position of an entry; if a term is not in the front position it has not been indexed. If the term indexed may appear (in Class P) in contexts other than the one here, it is qualified by the most appropriate term or terms from above, whereas the common divisions allow qualification of any concept by a limited set of commonly occurring facets (Form of presentation, Place, Period, etc.). Retroactive notation carries the main burden of synthesis in BC by allowing any term to be qualified by any other term from another facet or another array within the same class. Classmark building is effected by a process of 'going back' in the schedule to get earlier classmarks to add on -- hence the term 'retroactive synthesis'.

The problem retroactive notation needs to solve can be stated simply: because every class in the BC has an inverted schedule the basic rule for compounding any two classmarks is to take the one appearing later in the schedule and to add it to the one appearing earlier. Therefore, from the sequence.
It can be seen that if classmarks are needed for compounds such as the Curriculum in Primary education, or Primary school administration the problem is to add J to JK in the first case and JC to JM in the second.

Retroactive notation allows this to be done in the simplest possible manner. If, for example, classmarks were needed for Primary School curriculum and for Primary school administration, the classmark appearing later is taken first Primary school Curriculum JMK (Jk Primary education) and to it is added directly the classmark appearing earlier, or above it, dropping the initial 'J' since this is common to both classmarks and has already been given. In the first case, we obtain JMK (Education-Primary-Curriculum) and in the second case we obtain JMC (Education-Primary-School Administration).

Weaknesses of the Bibliographic Classification:

The most serious weakness, which undoubtedly marks every other general system apart from Colon, 'is the failure to observe strictly the fundamental rule of classification, which is to apply one principle of division only at a time and to
exhaust it before applying another, in other words the modern techniques of 'facet analysis' as developed by Ranganathan in his Colon Classification. Lack of facet analysis reduces the hospitality of the BC system and also introduces a lack of predictability for the indexers. Where would Marketing Personnel go in the Class UVP - Paper technology -- in, R Marketing or, G Personnel.

However, this weakness is one common to all the major "enumerative systems."

The major theoretical developments of twentieth-century classification have been most clearly formulated by S.R. Ranganathan, who concentrated his attention in an almost mathematical way on the general structure of knowledge. He designed a classification in which compound subjects were built up synthetically from elementary concepts. His notational devices represent combinations by a system of ordinal numbers.

