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Chapter 3

DESIGN OF DEPTH CLASSIFICATION : METHODOLOGY

S.R. RANGANATHAN

Begins with a rapid account of the evolution of the practice and theory of classification during the last one hundred years and of concepts and the terminology associated therewith. Then follows an account of the successive removal, during the last forty years, of six inhibitions in the Idea Plane in the development of CC caused by the Notational Plane and of the inhibitions in the Notational Plane itself caused by the DC tradition. Shows the greater practicability of the method of First-Link-Downwards Approach than that of the Last-Link-Upwards Approach. Recommends the blending of the speculative method and the pragmatic method as a corrective of each other, at convenient stages, in designing a scheme for classification. After introducing a new and more easily applicable use of the terms 'Sector' and 'Zone' in the Notational Plane of CC, shows the number of true (IN) available in an array of order 1 to be 100 if the number of digits in an (AIN) is not to exceed 1;400 if it is not to exceed 2; and 1,000 if it is not to exceed 3. Gives a scheme of allocation of the sectors to (WI), ($\overline{\text{WI}}$), and ($\overline{\overline{\text{WI}}}$). Lays down a procedure for determining the necessary first characteristics — that is (QI) — and determining their sequence with the aid of the Wall-Picture Principle in the design of classification. States that the Telescoping in Array made possible in this procedure satisfies the finding of the physiology of the eye and of the psychology of memory. Describes seven steps in the design of depth classification. Traces the progressive elimination of Gap Device in notation. Shows the training in the methods of applied research in the designing of classification to be essential for a documentalist as distinct from a generalist librarian.

ABBREVIATIONS USED

(ACI) = Anteriorising Common Isolate
(AIN) = Array Isolate Number
(BC) = Basic Class
(BCN) = Basic Class Number
CC = Colon Classification
(CC) = Canonical Class
(CCN) = Canonical Class Number
(CdC) = Compound Class
(CEI) = Common Energy Isolate
(CI) = Common Isolate
(CIN) = Common Isolate Number
(CMI) = Common Matter Isolate
(CN) = Class Number
(CPI) = Common Personality Isolate
(CS) = Connecting Symbol
(CxC) = Complex Class
DC = Decimal Classification
[E] = Energy Facet
EC = Expansive Classification
FC = Fundamental Category
IAN = Indo-Arabic Numerals
I = Isolate(s)
(IF) = Isolate Facet
(IN) = Isolate Number
LC = Library of Congress Classification
[M] = Matter Facet
(M C) = Main Class
(MCN) = Main Class Number
[P] = Personality Facet
[1P1] = Level 1 in Round 1 of [P]
[1P2] = Level 2 in Round 1 of [P]
[P3] = Level 3 of [P]
(QI) = Quasi Isolate
(QIN) = Quasi Isolate Number
[S] = Space Facet
SC = Subject Classification
(SI) = Space Isolate
(SID) = Super-Imposition Device
(SII) = Super-Imposed Isolate
(SpEI) = Special Energy Isolate
(SpI) = Special Isolate
(SpMI) = Special Matter Isolate
(SpPI) = Special Personality Isolate
[T] = Time Facet
(TI) = Time Isolate
(W) = Whole
($\underline{W}$) = Organ of Remove 1
($\underline{\underline{W}}$) = Organ of Remove 2
(WI) = Whole Isolate
($\underline{W}$I) = Organ of Remove 1 Isolate
($\underline{\underline{W}}$I) = Organ of Remove 2 Isolate

1 INTRODUCTION

1.0 Classification

The term 'Classification' is a homonym. It can denote any one of three ideas. We shall denote them by the respective terms:

1. Formation of groups — classification in sense 1 — Grouping;
2. Formation of groups and arranging them in a helpful sequence — classification in sense 2 — Arranging; and
3. Formation of groups – arrangement of the groups in a helpful sequence, and representing the groups by ordinal numbers denoting their respective positions in the sequence — classification in sense 3 — Library Classification.

1.1 Sense 1 - Grouping

In its first sense, classification means dividing the existents of the universe of discourse — concrete or conceptual, things or ideas into different groups [10]. Each group is to contain only like existents but no unlike existents. The terms 'Like' and 'Unlike' are in respect of a single attribute or a complex of attributes. Classification in this primitive sense should have originated with the primitive man. It is practised very early in childhood. It may be done on the basis of a single characteristic to begin with. But, with the evolution and the development of the cortex of the brain, the single characteristic has been giving place to a characteristic-complex; the complex itself has been steadily increasing in complexity. A single characteristic gives place to a Train of Characteristics. DC represents this stage. A single train of characteristics has now given place to a sequence of Trains of Characteristics. CC represents this stage.

1.2 Sense 2 – Arranging

In its second sense, classification is arranging the groups formed by the classification in sense 1 [22]. The groups can be arranged in one or other of several sequences. In fact the number of

possible sequences equals the number of permutations of the groups. One of these sequences has to be preferred in classification in sense 2. The sequence preferred should be one as helpful as possible for the purpose to be served by the arrangement. We shall call it Helpful Sequence. There is an inherent urge in man to classify in sense 2. Probably it is a neural necessity. Arrangement in a sequence is in effect a Linear Arrangement. But the universe of knowledge is a multi-dimensional one. Therefore, classification in sense 2 – that is, arranging virtually amounts to mapping a multi-dimensional space on a uni-dimensional space – that is, a line. To change the analogy, it amounts to transforming a multi-dimensional space into a uni-dimensional one. It has been found in cartography and mathematics that such a mapping or transformation cannot keep invariant all the interrelations of the entities of the original, multi-dimensional universe.

1.2.1 Invariant

The problem is what should be preferred to be kept invariant. A fundamental approach to the answer to this question has yet to be made. The work of successive classificationists implies some of them having preferred different *invariants.* There was not any substantial difference in the *invariants* preferred in DC, EC, and LC. But the *invariant* preferred by the SC was different. The essence of this difference centres round the Categorical Tables of SC. The invariants preferred by CC are still more different. In fact they are of a complex nature. The essence of this difference centres round its phase-analysis and facet-analysis with its basis of five Fundamental Categories and its Round and its Levels. However helpful and even necessary such a complex of invariants may be in mapping the universe of knowledge of today on a uni-dimensional space, the inertia and the conservatism of some librarians make them allergic to it. They

oppose it. They denounce it. But this cannot hold back the work of the forward – looking librarian.

1.2.2 Qualities of the Universe of Knowledge

A theoretical determination of the helpful complex of *invariants* to be aimed at in classification in sense 2 is made even more difficult by some of the qualities of the universe of knowledge.

1.2.2.1 Many dimensions

In the first place it is a multi-dimensional universe as already stated. By this, we mean that many parameters are needed to describe the position of any existent or any group of existents in that universe. As the universe of knowledge is developed by research, the number of parameters steadily increases.

1.2.2.2 Infinite

Secondly, the universe of knowledge is infinite. In other words, the number of items of knowledge – that is existents – in that universe is unlimited. The mass or the extension of an item of knowledge may be very small at one extreme and very large at the other.

1.2.2.3 Dynamic

Thirdly, this infinite universe is ever – growing. There are new developments in it from time to time. It throws forth new items of knowledge. Some of these new items could not be anticipated almost

till they actually appeared. We do not know what comes round the corner at any moment. It may be a massive item of knowledge comparable to what we call (BC); or it may be tinear than any item known hitherto. Indeed the universe of knowledge is dynamic – turbulently dynamic – with capacity to throw forth, for ever, new items of knowledge, calling for their own respective positions among the ones already existing.

1.2.2.4 Continuum

Fourthly, it is conjectured that the universe of knowledge is a continuum, that is, it has no holes. Whatever be the holes currently present in the universe of knowledge, it is believed that, with the development of the universe of knowledge through research, the holes will be successively filled up. In other words, it is our faith that any spot in the universe of knowledge lying fallow up to any moment will be cultivated at a later time. All these factors call for a more powerful and penetrating analysis and methodology than available at present, to determine the most helpful complex of invariants to be preserved in the preferred linear sequence of the items of knowledge – past, present, and future.

1.2.3 Alternative Method

In this circumstance, an alternative method for meeting the problem of classification in sense 2 is to set up several alternative models of classification. The state of universe of knowledge at any one moment may indicate which of the alternative models would be most helpful [7,25]. For example, a hundred years ago a severely

enumerative model proved sufficient. DC is an approximation to it, though it deviates slightly from being severely enumerative. Several successive unconscious deviations were made later. In some the deviations were significant. A classification grafting an analytico-synthetic superfices to the old enumerative core was felt to be necessary at the turn of the present century. UDC was the result. Today, a classification going the whole hog along analytico-synthetic line is realized to be a necessity [3]. CC is the result – particularly in its current stage of development. Another alternative name for such a classification is faceted classification. Forward-looking librarians have realised that the necessity has already come for faceted models of classification. They are experimenting with diverse models of faceted classification [2].

1.2.4 Postulational Approach

The experiments show that the mere fact of a scheme being faceted does not go the whole way in determining the invariant-complex to be preserved. It is felt that the desirable invariant-complex cannot be seized with our present methodology and mode of thinking, by searching for them in the phenomenal, surface level of the universe of knowledge. At this level, the invariant-complex appears to play the will-o-the-wisp. To escape its tantalisation a break through the phenomenal surface level has been made and a dive taken towards the noumenal seminal level. This break-through has resulted in the avoidance of the tantalising situation experienced all along. Since 1957, this break-through has enabled us to base the design of classification on a set of Postulates for the identification and separation of the facets of a subject and a set of Principles for

determining the helpful sequence of all such facets [18], for work in the Idea Plane. These have reinforced the principles already formulated to arrive systematically at a helpful sequence of isolates in an array and of classes in general [19]. The advantage of postulates is that the question of their being right or wrong does not arise. The only reason for accepting them is that work based on them leads to a helpful sequence of the classes in the universe of knowledge. The helpfulness of the resulting sequence of classes is as if the invariant-complex were found out and preserved in the linear arrangement. This idea was first formulated in respect of design of classification at the Dorking Conference in 1957 [15]. During the last seven years it has been found that basing design of classification on the postulates and principles mentioned above has yielded a helpful sequence among classes presenting several rounds and levels of facets. This helpfulness implies that the right invariant-complex is preserved though we are not yet able to formulate it in explicit terms. With the confidence generated by this experience, schemes of depth classification for applied sciences are being designed at the DRTC, Bangalore. The results are encouraging.

1.2.5 Scheme of Classes

In relation to enumerative classification, a statement of the classes of knowledge in their helpful sequence is known as a Scheme *of* Classes.

1.2.6 Scheme for Classes.

Even in relation to faceted classification, a Scheme *of* Classes is possible. But it is not necessary to provide it except for the use of

beginners and for use in generalist libraries having to arrange only conventional books embodying macro thought and to arrange the main entries of whole books. Most classes in such a Scheme *of* Classes will be such composite ones as can be synthesised out of a (BC) and a few – say two or three or rarely five – facets, that is isolates. Whatever be the prevision of the classificationists, such a Scheme *of* Classes will become inadequate sooner or later. For, it would amount to attempting to foist an enumerative garb on an analytico-synthetic classification defying enumeration. Further, the length of a fairly exhaustive Scheme *of* Classes will be un-economical in the measure of the relative numerousness of ($m \times n \times p \times q \times r$) over ($m+n+p+q+r...$) Therefore in a faceted classification a Scheme *for* Classes is given instead of a Scheme *of* Classes. The Scheme *for* Classes consists of many lists of schemes instead of a single one. First comes the Scheme *of* (BC). Then in association with each (BC), there are a number of Schemes *of* Isolates. Each Scheme *of* Isolates takes care of one of the many successive facets likely to be presented by one or other of the diverse subjects sharing that (BC). Of course, such of the Schemes *of* Isolates as are likely to recur in association with all or many (BC) may be given as Schemes *of* (CI) immediately after the Scheme *of* (BC). The Scheme *of* (BC), the Scheme *of* (CI), and the Scheme *of* (SpI) set up in association with the respective (BC) taken together, constitute the Scheme *for* Classes. In the Scheme for classes of a faceted classification, enumeration is resorted to only in the constituent Schemes *of* (BC) and of the several kinds of isolates.

1.3 Sense 3 - Library Classification

In library classification, each (BC), each (I), and each class made of a (BC) and one or more isolates is represented by an ordinal

number called respectively (BCN), (IN), and (CN). Of course, if the Scheme is enumerative, there will be (CN) only.

1.3.1 Schemes for Classification

In an enumerative classification each class in the Scheme *of* Classes is fitted with its (CN). The result is a single Schedule *of* Classes. It forms the Scheme *of* Classification. On the other hand in a faceted classification we do not get a single schedule. Each (BC) in the Scheme *of* (BC) is fitted with its (BCN). The result is the Schedule *of* (BC). Each (I) in each Scheme *for* (CI) is fitted with a (CIN). These then become the respective Schedules of (CI). In each Scheme *of* (SpI) going with the respective (BC), each (I) is fitted with an (IN). The result is as many Schedules *of* (SpI) as there are Schemes *of* (SpI). The totality of the Schedule *of* (BC) and the Schedules *of* (I) — common as well as special – constitutes the Scheme *for* Classification in an analytico-synthetic or a faceted classification.

1.4 Chart of Equivalent Terms

For convenience in exposition a few other terms are introduced to denote generically or severally classes and isolates of different kinds. There are parallel terms for use in the Idea Plane, the Verbal Plane, and the Notational Plane respectively. The Documentation Committee of the Indian Standards Institution has established a Standard in respect of these terms. They are given below in tabular form [4]. This tabular context lays bare the meaning of each term.

Note: In any set of equivalent terms, the term in the Idea Plane has been defined. Some of the other terms have been defined when expediency required, but not all.

Generic	In the Idea Plane	In the Verbal Plane	In the Notational Plane
Focus	Class Isolate Idea Array Isolate Idea	Subject Isolate Term Array Isolate Term	Class Number Isolate Number Array Isolate Number
Basic Focus	Basic Class	Basic Subject	Basic Class Number
Main Focus	Main Class	Main Subject	Main Class Number
Canonical Focus	Canonical Class	Canonical Subject	Canonical Class Number
Isolate	Isolate Idea	Isolate Term	Isolate Number
Common Isolate	Common Isolate Idea	Common Isolate Term	Common Isolate Number
Anteriorising Comm on Isolate	Anteriorising Common Isolate Idea	Anteriorising Common Isolate Term	Anteriorising Common Isolate Number
Posteriorising Common Isolate	Posteriorising Common Isolate Idea	Posteriorising Common Isolate Term	Posteriorising Common Isolate Number
Array Isolate	Array Isolate Idea	Array Isolate Term	Array Isolate Number
Facet	Basic Class Isolate Idea	Basic Subject Isolate Term	Basic Class Isolate Number
Basic Facet	Basic Class	Basic Subject	Basic Class Number
Isolate Facet	Isolate Idea	Isolate Term	Isolate Number
Compound Focus	Compound Class	Compound Subject	Compound Class Number

Generic	In the Idea Plane	In the Verbal Plane	In the Notational Plane
Complex Focus	Complex Class	Complex Subject	Complex Class Number
Complex Isolate	Complex Isolate Idea	Complex Isolate Term	Complex Isolate Number
Complex Array Isolate	Complex Array Isolate Idea	Complex Array Isolate Term	Complex Array Isolate Number
Biasing Focus	Biasing Class	Biasing Subject	Biasing Class Number
Biasing Isolate	Biasing Isolate Idea	Biasing Isolate Term	Biasing Isolate Number
Biasing Array Isolate	Biasing Array Isolate Idea	Biasing Array Isolate Term	Biasing Array Isolate Number
Comparison Focus	Comparison Class	Comparison Subject	Comparison Class Number
Comparison Isolate	Comparison Isolate Idea	Comparison Isolate Term	Comparison Isolate Number
Comparison Array Isolate	Comparison Array Isolate Idea	Comparison Array Isolate Term	Comparison Array Isolate Number
Difference Focus	Difference Class	Difference Subject	Difference Class Number
Difference Isolate	Difference Isolate Idea	Difference Isolate Term	Difference Isolate Number
Difference Array Isolate	Difference Array Isolate Idea	Difference Array Isolate Term	Difference Array Isolate Number

Generic	In the Idea Plane	In the Verbal Plane	In the Notational Plane
Influencing Focus	Influencing Class	Influencing Subject	Influencing Class Number
Influencing Isolate	Influencing Isolate Idea	Influencing Isolate Term	Influencing Isolate Number
General Relation Focus	General Relation Class	General Relation Subject	General Relation Class Number
General Relation Isolate	General Relation Idea	General Relation Isolate Term	General Relation Isolate Number
General Relation Array Isolate	General Relation Array Isolate Idea	General Relation Array Isolate Term	General Relation Array Isolate Number

1.5 Basic Class and Isolate

All along we have been using the terms (BC) and (I) without definition. At present we have no formal definition for them. We have to define them only by enumeration.

E118	Chemistry of gold	ND,7;618	Numismatics of gold
F118	Metallurgy of gold	X61,2	Gold as a medium of currency
HX118	Mining of gold	Y:86,3	Sociology of gold
HX118.2	Mining of gold in India	Z26(E118)	Gold as a movable property

Note : For Gold currency and Gold ornament, the material characteristic is used to construct the schedule for [1P1]. The sector (s-1) is used for it. In this sector, digit 1 stands for the (QI) Material. The array of order 2 listing the individual materials is telescoped into array of order 1. Gold occupies the first place among the materials used for currency or ornament. therefore, it is represented by the digit 2. This is in accordance with the latest principles for design of classification being expounded in this series of articles.

1.6 Main Class and Canonical Class

(BC) is a generic term to denote a (MC) or a (CC). A formal definition of these two terms is also difficult. They have to be defined by enumeration only. We can only say that a (MC) may comprehend many (CC). For example, the (MC) B Mathematics comprehends the following (CC) among others:

B1	Arithmetic	B24	Determinant
B11	Lower Arithmetic	B245	Matrix
B13	Integer	B3	Analysis
B15	Ideal number	B32	Calculus
B16	Complex number	B321	Differential
B18	Transcendental number	B325	Integral
B2	Algebra	B33	Differential equation
B22	Continued fraction	B6	Geometry
B23	Theory of equation	B7	Mechanics

Similarly the (MC) D Engineering comprehends the following (CC) among others:

D2	Building
D3	Irrigation
D4	Track
D411	Highway
D415	Rail road
D416	Bridge
D5	Sanitary
D55	Water supply
D551	Head work
D8	Machine tool (Production)
D82	Wood cutting tool
D85	Metal cutting tool
D9a	Machine elements (Production)
D91	Vehicle (Production)
D554	Water pollution
D556	Water distribution
D56	Sewage
D6	Power(Production) engineering
D7	Service (Production) engineering
D7Z	Commodity (Production) engineering
D92	Land vehicle
D9A	Special purpose machinery
D9N	Electronic equipment
D9R	Nuclear power equipment

The above is a modification of the schedule given in CC ed 6. This modification has been made in the light of the experience gained during the last two years in discussing in DRTC the Principles for the Design of Classification and in getting a better understanding of the concept of (CC). This matter will be presented in a later paper after more experience is gained. At present it is difficult to say whether we begin with the ultimate (CC), and name the (MC) comprehending them or whether we begin with certain postulated (MC) and break down some of them into (CC). The only fact that we can now state is that each (MC) and each (CC) have a considerable literary warrant. There are also some partial comprehensions of (MC) with literary warrant. The following are some examples among others:

A	Natural science (General)	MZ	Humanities and Social sciences
AZ	Mathematical sciences		
BZ	Physical sciences	MZ	AHumanities
FZ	Mining and Metallurgy	NZ	Literature and Language
GZ	Earth sciences (Geology and Geography)	SZ	Social sciences

In CC, digit Z is used as the mnemonic digit for partial comprehension. It is taken to be an 'Emptying Digit' — that is it empties the preceding digit of its semantic richness, though allowing the retention of its ordinal value [8]. For example in SZ, the digit S does not represent Psychology. In fact in this context it does not by itself represent any subject whatever. But the digit-pair SZ represents Social Sciences. The result of retaining the ordinal value of S is that SZ is coordinate with S and T and comes between them.

1.7 Number of (BC)

Till now the number of (MC) was taken to be very limited. But in recent years several methodologies have gained literary warrant entitling them to the status of (MC). Here are some examples:

PX	Communication theory	XX	Management (General theory)

Apart from this several classes, forcedly accommodated as sub-classes of the other (MC) in order to meet exigencies in notational construction, have been all along insisting on their status as co-ordinate (MC) being implemented in the Notational Plane. Here are some examples:

HX	Mining	LX	Pharmacognosy
KX	Animal husbandry		

In CC the digit X is taken to be an 'Emptying Digit'. The digit-pair made of an Emptied and an Emptying Digit is semantically rich. It represents a (MC). It is co-ordinate with the digit Emptied. Thus KX Animal Husbandry is co-ordinate with K Zoology and L Medicine. In CC the digits T to Y are given this property. This, taken with other concepts fits the Notational Plane to receive an infinity of (MC) – that is classes in the array of order 1 got by dividing the universe of knowledge. Further, in the clearer comprehension of the concept of (CC) now being got, the number of (CC) seems to be very large. Thus the number of (BC) is very large. Theoretically it tends to infinity.

1.7.1 Implication of Infinity

The above realization fits in with the concept of the universe of knowledge being infinite – that is the number of items of knowledge past, present, and future taken together tends to infinity. The elemental items of knowledge consists of (BC) and (I). The total number of all the (CI) – including (TI) of all levels, (SI) of all levels, the (CEI), the Common Property Isolates, the Common Value Isolates, the (CPI), the (ACI) – is very large. The number of Commodity Isolates is also very large almost of the order 10^{10} as they are today. The number of (SpI) likely to go with the respective (BC) – including the (SpEI) of all rounds, the (SpMI), (SpPI) of all levels in all rounds – is also very large. We may say that the number of (I) tends to infinity. Still more the number of (CdC) and (CxC) tends to infinity. By removing from the infinite universe of knowledge the infinite universe of (I), (CdC) and (CxC), we get the universe of (BC) as the residue.

That the residue should be also be infinite has been sensed from Vedic times. For, according to a Vedic statement if infinity is taken away from infinity, then infinity itself will be left as residue. This represents the intuitive grasp of a certain experience by the seers of yore. In recent years, the intellectual work of mathematicians has led to the statement of the same result as a Postulate about Infinity. Restricting the (BC) to a small number has all along been giving an uneasiness in mind. We now realize that it might have been due to the inhibition of the Idea Plane by the limitedness of the base in the Notational Plane. The concept of Emptying Digit has now fitted the Notational Plane to accept any number of (BC) interpolatable between any two existing (BC). The opening of Zone 4 by the Packet Notation has fitted the Notational Plane to accept any number of (BC) extrapolatable at the end of the already existing sequence of (BC).

1.7.2 Scope of this Series

In this series of papers on design of classification, the design of the sequence of the Schedule of (BC) may be taken up only sparingly by way of illustration. For, what has been said already gives sufficient indication as to how the problem can be dealt with. All that we have to do is to remember the Canon of Filiatory Sequence [5]. The papers in this series will be mostly on the design of schedules of (CI) and the schedules of (PI). Some work has already been done on the (CI) of [T] [24] and of [S] [23] of different levels needed for depth classification. The work on the other (CI) is in progress. The earlier papers in this series will be devoted to the working out of the schedules of (SpI) of all rounds and levels likely to be presented by subjects including those of deep intention, sharing some specific (BC). In any single paper we shall generally consider only a single (BC) and a schedule of (SpI) of the compound subjects derivable from it.

2 IDEA PLANE AND NOTATIONAL PLANE

2.1 Inhibition 1 and Connecting Symbol Colon

All along, work in the Idea Plane had been considerably inhibited by the limitations in the Notational Plane. For example, though a subject presented two or more unmistakably distinct facets, the limitations of the monolithic notation had inhibited DC from giving equal weight and equal facility for expansion of each of the facets. This made DC ignore the findings of the Idea Plane and forcedly prefer one of the facets alone for full representation in the (CN). In due course, practice with DC both during the process of classifying and while doing reference service had inhibited the mind from even recognizing the overlooked facets in a subject. But this inhibition was removed when the connecting symbol Colon lying in the lowest region of the ordinal scale was introduced by CC to serve at once both the functions of separating the facet numbers and as well as connecting them. This notation may be described as polylithic.

2.2 Inhibition 2 and Five Connecting Symbols

The use of a single connecting symbol for all the facets worked fairly well in the classification of conventional books embodying macro thought. But when articles embodying micro thought had to be classified to serve the needs of documentation, to the full satisfaction of the Laws of Library Science, the Notational Plane was subjected to a terrible strain. As if in sympathy with this predicament of the Notational Plane, the Idea Plane was tempted to inhibit itself and suppress its full findings. The stage of the polylithic notation of CC brought classification of micro thought to the same gross condition as

the monolithic notation of DC had brought classification of macro thought. In due course, practice with the first 1924 version of CC both during the process of classifying and while doing reference service, had inhibited the mind from even recognizing the difficulties. But this inhibition was removed when the single connecting symbol colon (:) was replaced by the five connecting symbols (single inverted comma, dot, colon, semicolon, and comma), all lying in the lowest region of the ordinal scale. The Notational Plane thus overcame its own limitations. This enabled the Idea Plane to overcome its inhibition 2 and put forth the Postulate of (FC) [17]. These results were implemented for the first time only in Ed. 4 of CC in 1952.

2.3 Inhibition 3 and Length of the Base

Even in the 1924 version of CC, the base of its notation had three zones:

1. The 23 Roman smalls excluding i,l, and *o*;
2. The 9 Indo-Arabic Numerals; and
3. The 26 Roman caps for the array of (MC) and 24 Roman caps, excluding I and O, for all other arrays.

The three zones taken together yielded 58 (MCN) and 56 (IN) for other arrays. However, the entire range was utilised only in the Array of (MC). But this was not done in the case of an array of order 1 in any (IF). In array of order 1 of [T] the nine (IN) of zone 2 were not used. And in array of order 1 of [S] the (IN) of zone 3 were not used. This was due to the same (CS) having been used for [T] and [S]. This self-imposed restriction was however removed the moment the single inverted comma was introduced as (CS) for [T]. However, the (IN) of zone 1 were not brought into use in the array of order 1 of any of the (FC). Further, the (IN) of zone 3 were not brought into use in any

array of any order of any facet except [T] used by itself or used to represent [P]. In [P] it was used to represent either persons or 'Systems'. The (IN) in zone 1 were not brought into use anywhere except to represent (ACI). This neglect of zones 1 and 3 due to the pressure – unconscious though it was – of the DC tradition of using (IAN) alone. This neglect of zones 1 and 3 inhibited the Idea Plane from asserting some of its requirements such as (CEI), Common Property and Value (I), (CPI), and the second and later levels of [T] and [S]. In due course the Notational Plane became aware of the neglect of zones 1 and 3. Once the Notational Plane gained this awareness, the Idea Plane overcame its inhibition, and demanded the implementation of the requirements mentioned above. The results were embodied for the first time in Ed 5 of CC in 1957.

2.4 Inhibition 4 and Super-imposition

Even in Ed 1 (1933) of CC, the concepts of 'Super-Imposition' in the Idea Plane and of the (SID) in the Notational Plane had been seized. The digit hyphen (–) was taken as the (CS) between the components of Super-imposed (IN). Till ed 6, it was called 'Auto-bias Device'. The use of the old term cannot explain an inhibition in the Idea Plane presenting all along. For some inexplicable reason, the Super-Imposition concept was brought into use only in the Schedule for Organs going with the (BC) L Medicine. In spite of its giving a considerable help in subjects in Medicine, it was not extended to other subjects. The subjects in Y Sociology often called for the application of the Super-Imposition concept. But the Idea Plane was inhibited from responding to it. It is only during the last few months that the extension of the Super-Imposition concept was made to all subjects. This has naturally removed the inhibition in the Idea Plane.

2.5 Inhibi tion 5 and (W) and ($\overline{W}$)

One of the causes for failure to bring the concept of Super-Imposition into wide use was the experience with the Organ Schedule of L Medicine. In the human body, the Universe of Organs is made of sub-universes such as the Digestive System, the Circulatory System, and the Respiratory System. Each such sub-universe generally consists only of one (I). For example, there is only one mouth, one stomach, one liver, and so on. In certain cases, there are two (I). For example, there are two legs, two hands, two eyes, and so on. But there is not much occasion for distinguishing between two such (I) in the theoretical study of medicine – not taken to a great depth. Therefore, such a sub-universe also was treated as if it had only one (I). Thus, each sub-universe virtually turned out to be a unitary universe [26]. No further sub-division of it – that is a Unitary Universe – can yield a (W) Entity. On the other hand, the sub-division of any such sub-universe yielded only (W) Entity. Further, in the Notational Plane, for the isolate in each such sub-universe of organs consisted only of one digit, while moving from (W) to ($\overline{W}$) belonging to different levels of facets of the same (FC) in the same round. This inhibition was removed only when the concepts of (W) and ($\overline{W}$) were explicitly stated in 1953 [27].

2.6 Inhibi tion 6 and Quasi-isolate

The array of order 1 in the schedule for [1P1] going with (MC) Y Sociology is made of (QI) – that is first characteristics – instead of regular (I). This was the result of the subdivision of the universe of Social Groups demanding more than one first characteristic. Each first characteristic started its own Train of Characteristics. This method of allowing several Trains of Characteristics – each based on its own first characteristic – in [1P1] going with a (BC) occurs in the

applied sciences. The occurrence of several Trains of Characteristics led to the inhibition of the Idea Plane from recognizing that a combination of (I) drawn from two or more such Trains of Characteristics still belong to [1P1] only. As a result, the (I) drawn from the different Trains of Characteristics were treated as if they belonged to different levels of [P] in spite of their combination still yielding only (W) Entities. In other words, (W) Entities and ($\overline{W}$) Entities became indistinguishable in the Notational Plane. The realization was that each Train of Characteristics though apparently different, together constitute only a complex Train of Characteristics yielding only (WI). This is of course due to the (I) in arrays of order 1 of all such Trains of Characteristics being only (QI). Once this was recognized, the concept of 'Super-Imposition' gave a ready made way for combining the (I) drawn from different Trains of Characteristics into a single 'Super-Imposed Isolate' in [1P1]. This has come to be of immense use in the design of depth classification, particularly for the applied sciences.

3 IDEA PLANE

3.0 Two Directions of Approach

There are two ways along which the schedules of (I) going with a particular (BC) can be approached. One way will be to start with listing all the ultimate (CdC) having that (BC) and having literary warrant. We may describe this as the 'Last-Link-Upwards Approach'. The other way will be to start with the (BC) as the universe. We may arrive successively at link after link in each chain in each possible facet likely to be presented by subjects sharing the (BC). We may describe this way as 'First-link-Downwards Approach'.

3.1 Last-Link-Upwards Approach

In the Last-Link-Upwards Approach, the last link will be a subject and not an (I). While moving upwards, each link will be a class and not an (I). In fact, we shall be moving up a chain of (CdC). At each step we whould determine the constituent (I) or facets of the (CdC) concerned. The (I) of like kind occurring in all the links of the chain should be listed. These (I) should be arranged in a sequence of increasing extension. The sequences so got from all the last links should be established. The (IN) should be determined after the list of (I) is completed. This will prove to be maddening. Further, as a result of the ever growing nature of the universe of subjects sharing one and the same (BC), links of a lower order will be thrown forth by what was already taken as the last link in a chain. Thus what was taken to be the last link will thereafter cease to be the last link. Therefore, it looks as if the Last-Link-Upwards Approach will not be practicable unless the totality of the subjects sharing the given (BC) will be small even after full development. In fact, the last link either in the chain of subjects or in the chain of a particular facet is ever elusive. The term 'Inductive Scheme *of* Classification' has been suggested to denote the 'Last-Link-upwards Approach'. The impracticability of this approach was brought out in December 1952 [13].

3.2 First-Link-Downwards Approach

In the First-Link-Downwards Approach, the design of an analytico-synthetic or a faceted scheme of classification is based on postulates for the Idea Plane and the Notational Plane respectively.

The design of CC, for example, is based on a definite set of postulates given in the *Elements* [16]. To apply the postulates we have to conjecture the possible rounds and levels of each of the five (FC) which may appear even in a subject of the highest possible order of (CdC) [6] having the given (BC). As already stated we have to think only of the (SpI) in [P], or in [M], or in [E] of any round or any level. According to the experience gained so far, the (SpEI) will be only a few in each (BC). The (SpMI) will also be equally few. What is more significant is that the rate of increase in the number (SpI) of either kind will be extremely small. Further, the (SpEI) will be largely made of quasi-common isolates determinable by their seminal equivalents. Moreover the later the round the easier will be the design of the schedule in [E] and of the schedule in any level of [M]. Therefore, it is not proposed to deal with the design of the schedule for the (SpI) of [E] or [M], in the earlier articles of this series.

3.3 Reduction of Work on Schedule to (SpI) in [P]

On the other hand the number of relevant characteristics to be used as the basis for designing the schedule of (SpI) of [1P1] will be fairly large. The number of levels of [P] in round 1 will also be many at least two and often many more. The (SpI) in each of these [P] of round 1 will also be large and may call for more than one relevant first characteristic. The rate of increase in the number of (I) in [1P1] will be great. The work of constructing the schedules for the levels of [P] in round 1 will be arduous in many of the (BC) and particularly in applied sciences. We shall therefore begin this series with articles on the design of classification of (SpI) in [1P1], and [1P2] for subjects in applied sciences.

3.4 Blending of Methods

In the design of the schedules mentioned above we shall have to depend upon speculative method that is to start with conjecture. But depending solely on it may throw the schedules out of focus. The number of the facets as well as the enumeration of (I) in each facet may be thrown out of focus. A corrective should be applied to this by frequently looking into the literary warrant that is by pragmatic method. In fact, a judicious blending of the speculative and pragmatic methods is necessary. It is a matter of compromise between the two methods. Compromise between conflicting claims is a well-known principle in practical life. So it is in the design of classification too. In other words each method should be used as a check on the other. At what stages and how often the check up should be made will vary with the context of the subject and the experience of the designer of classification.

4 NOTATIONAL PLANE

4.1 Mixed Notation

The methodology for the design work in the Idea Plane discussed in Sec 3 and its subdivisions is available for use in any Scheme *of* Classification. But the methodology for design work in the Notational Plane should necessarily vary with the Notational System used by a scheme. Therefore, the discussion about the notational Plane will be confined to the CC. The notation of CC is a mixed one. The advantages of having a distinctive species of digits for use as (CS) in an analytico-synthetic or a faceted scheme of classification has been already discussed in Sec 2.2. The semantically rich digits [21] of CC are drawn from three species. The use of packet notation

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starter and arrester amounts virtually to the use of a fourth species of semantically rich digit; for, a packeted number can be treated as if it were a single digit of a new species. The number within the brackets may consist of any number of digits and of any species of digits, including (CS) and packet number itself.

4.2 Zone and Sector Formation in Array of Order 1

Let us remember that we are now interested only in the design of the schedule corresponding to the several (IF) going with a particular (BC). Further, let us also remember that in the earlier papers of this series we shall confine ourselves to the array of order 1 of a facet. Further, we shall take into account only such packeted (IN) as have a single semantically rich digit. Still further, we shall use the terms 'zone' and 'sector' to cover different parts of the array as shown in the following table:

Zone	Sector	(AIN)	Total of (AIN) for	
			Sector	Zone
1	(S – a)	a, b ..... z	23	23
2	(S – 1)	1, 2 9	9	9
3	(S – A)	A, B ..... Z	24	24
4	(S – (a))	(a) (b) ..... (z)	23	23
5	(S – (1))	(1), (2) ..... (9)	9	9
6	(S – (A))	(A), (B) ..... (Z)	24	24
Total	6 sectors			112

4.3 Table for Boundary Condition 1

Note: The few cases in which I and O can occur within brackets have been ignored in this census.

Annotation 1

The symbol used to denote a sector as shown in columm 2 of the above table should be noted. It is a helpful descriptive symbol. It satisfies the Law of Parsimony in thinking, in expressing, and in writing.

Annotation 2

In what follows, when we speak of 'number of digits' in packeted (AIN) – that is, an (AIN) of zone 4 – we shall mean only the 'number of digits within the brackets'. From the table, it follows that the total number of one-digited (AIN) available in any array of order 1 of a facet is apparently 112. But it is wise to make the digits z, 9, and Z Empty Digits, in order to have infinite hospitality within each zone. Further, we must be prepared to use the first digit or each zone that is *a*, 1 and A – to represent a (QI) – that is, a characteristic instead of a true (I). Therefore, we have the following results:

4.3.1 Census for Boundary Condition 1

With one digit as the boundary condition for the number of digits in an (AIN) of order 1, the number of sectors available is 6 and the number of (AIN) available is 100.

4.4 Table for Boundary Condition 2

We shall use the term sector to cover different parts of each of the different zones of the array as shown in the following table:

Zone	Sector	(AIN)	Total of (AIN) for	
			Sector	Zone
1	(S-a)	a, b .. y	22	
	(S-za)	za, zb .. zy	22	
	(S-z1)	z1, z2 .. z8	8	
	(S-zA)	zA, zB .. zY	23	75
2	(S-1)	1, 2 .. 8	8	
	(S-9a)	9a, 9b .. 9y	22	
	(S-91)	91, 92 .. 98	8	
	(S-9A)	9A, 9B .. 9Y	23	61
3	(S-A)	A, B .. Y	23	
	(S-Za)	Za, Zb .. Zy	22	
	(S-Z1)	Z1, Z2 .. Z8	8	
	(S-ZA)	ZA, ZB .. ZY	23	76
4	(S-(a))	(a), (b) .. (y)	22	
	(S-(za))	(za), (zb) .. (zy)	22	
	(S-(z1))	(z1), (z2) .. (z8)	8	
	(S-(zA))	(zA), (zB) .. (zY)	23	
5	(S-(1))	(1), (2) .. (8)	8	
	(S-(9a))	(9a), (9b) .. (9y)	22	
	(S-(91))	(91), (92) .. (98)	8	
	(S-(9A))	(9A), (9B) .. (9Y)	23	
6	(S-(A))	(A), (B) .. (Y)	23	
	(S-(Za))	(Za), (Zb) .. (Zy)	22	
	(S-(Z1)	(Z1), (Z2) .. (Z8)	8	
	(S-(ZA))	(ZA), (ZB) .. (ZY)	23	212
Total Sectors	24			424

Here again we must be prepared to use the first digit of each sector to represent a (QI). Therefore we have the following result:

4.4.1 Census for Boundary Condition 2

With two digits as the boundary condition for the number of digits in an (AIN) of order 1, the number of sectors available is 24 and the number of (AIN) available is 400.

Annotation 1

In some of the sectors the (AIN) has apparently two digits. In all such cases the first digit is empty. Therefore, in all the (AIN) there is only one semantically rich digit. Therefore, all the 400 (I) are co-ordinate ones belonging to a single array as viewed from the Idea Plane.

4.5 Table for Boundary Condition 3

In passing from Sec 4.2.1 to 4.3.1 we increase the number of sectors from 6 to 24. We also increase the number of (AIN) from 100 to 400. This, we were able to secure by using the Empty Digits z, 9, and Z once and only once. This meant increasing the boundary condition for the number of digits in an (AIN) from 1 to 2. If necessary we can increase the boundary condition for the number of digits still further from 2 to 3. This can be done by using the following nine combination of Empty Digits:

zz	9z	Zz
z9	99	Z9
zZ	Zz	ZZ

The following table gives the result:

Zone	Sector	(AIN)		Total of (AIN) for Sector	Zone
1	(S-a)	a, b	.. y	22	
	(S-za)	za, zb	.. zy	22	
	(S-zza)	zza, zzb	.. zzy	22	
	(S-zz1)	zz1, zz2	.. zz8	8	
	(S-zzA)	zzA, zzB	.. zz8	23	
	(S-z1)	z1, z2	.. zzY	8	
	(S-z9a)	z9a, z9b	.. z8	22	
	(S-z91)	z91, z92	.. z98	8	
	(S-z9A)	z9A, z9B	.. z9Y	23	
	(S-zA)	zA, zB	.. zY	23	
	(S-zZa)	zZa, zZb	.. zZy	22	
	(S zZ1)	zZ1, zZ2	.. zZ8	8	
	(S-zZA)	zZA, zZb	.. ZY	23	234
2	(S-1)	1,2	.. 8	8	
	(S-9a)	9a, 9b	.. 9y	22	
	(S-9za)	9za, 9zb	.. 9zy	22	
	(S-9z1)	9z1, 9z2	.. 9z8	8	
	(S-9zA)	9zA, 9zB	.. 9zY	23	
	(S-91)	91, 92	.. 98	8	
	(S-99a)	99a, 99b	.. 99y	22	
	(S-991)	991, 992	.. 998	8	
	(S-99A)	99A, 99B	.. 99Y	23	
	(S-9A)	9A, 9B	.. 9Y	23	
	(S-9Za)	9Za, 9Zb	.. 9Zy	22	
	(S-9ZA)	9ZA, 9ZB	.. 9ZY	23	220

Zone	Sector	(AIN)	Total of (AIN) for Sector	Zone
3	(S-A)	A, B .. Y	23	
	(S-Za)	Za, Zb .. Zy	22	
	(S-Zza)	Zza, Zzb .. Zzy	22	
	(S-Zz1)	Zz1, Zz2 .. Zz8	8	
	(S-ZzA)	ZzA, ZzB .. ZzY	23	
	(S-Z1)	Z1, Z2 .. Z8	8	
	(S-Z9a)	Z9a, Z9b .. Z9y	22	
	(S-Z91)	Z91, Z92 .. Z98	8	
	(S-Z9A)	Z9A, Z9B .. Z9Y	23	
	(S-ZA)	ZA, ZB .. ZY	23	
	(S-ZZa)	ZZa, ZZb .. ZZy	22	
	(S-ZZ1)	ZZ1, ZZ2 .. ZZ8	8	
	(S-ZZA)	ZZA, ZZB .. ZZY	23	235
4	(S-(a))	(a), (b) .. (y)	22	
	(S-(za))	(za), (zb) .. (zy)	22	
	(S-(zza))	(zza), (zzb) .. (zzy)	22	
	(S-(zz1))	(zz1), (zz2) .. (zz8)	8	
	(S-(zzA))	(zzA), (zzB) .. (zzY)	23	
	(S-(z1))	(z1), (z2) .. (z8)	8	
	(S-(z9a))	(z9b), (z9b) .. (z9y)	22	
	(S-(z91))	(z91), (z92) .. (z98)	8	
	(S-(z9A))	(z9A), (z9B) .. (z9Y)	23	
	(S-(zA))	(zA), (zB) .. (zY)	23	

Zone	Sector	(AIN)		Total of (AIN) for Sector	Zone
	(S-(zZa))	(zZa), (zZb)	.. (zZy)	22	
	(S-(zA1))	(zZ1), (zZ2)	.. (zZ8)	8	
	(S-(zZA))	(zZA), (zZB)	.. (zZY)	23	234
5	(S-(1))	(1), (2)	.. (8)	8	
	(S-(9a))	(9a), (9b)	.. (9y)	22	
	(S-(9za))	(9za), (9zb)	.. (9zy)	22	
	(S-(9z1))	(9z1), (9z2)	.. (9z9)	8	
	(S-(9zA))	(9zA), (9zB)	.. (9zY)	23	
	(S-(91))	(91), (92)	.. (98)	8	
	(S-(99a))	(99a), (99b)	.. (99y)	22	
	(S-(991))	(991), (992)	.. (998)	8	
	(S-(99A))	(99A), (99B)	.. (99Y)	23	
	(S-(9A)	(9A), (9B)	.. (9Y)	23	
	(S-(9Za))	(9Za), (9zb)	.. (9ZY)	22	
	(S-9Z1))	(9Z1), (9Z2)	.. (9Z8)	8	
	(S-(9ZA))	(9ZA), (9ZB)	.. (9ZY)	23	220
6	(S-(A))	(A), (B)	.. (Y)	23	
	(S-(Za))	(Za), (Zb)	.. (Zy)	22	
	(S-(Zza))	(Zza), (Zzb)	.. (Zzy)	22	
	(S-(Zz1))	(Zz1), (Zz2)	.. (Zz8)	8	
	(S-(ZzA))	(ZzA), (ZzB)	.. (ZzY)	23	
	(S-(Z1))	(Z1). (Z2)	.. (Z8)	8	

Zone	Sector	(AIN)	Total of (AIN) for	
			Sector	Zone
	(S-(Z9a))	(Z9a), (Z9b) .. (Z9y)	22	
	(S-(Z91))	(Z91), (Z92) .. (Z98)	8	
	(S-(Z9A))	(Z9A), (Z9B) .. (Z9Y)	23	
	(S-(ZA))	(ZA), (ZB) .. (ZY)	23	
	(S-(ZZa))	(ZZa), (ZZb) .. (ZZy)	22	
	(S-(ZZ1))	(ZZ1), (ZZ2) .. (ZZ8)	8	
	(S-(ZZA))	(ZZA), (ZZB) .. (ZZY)	23	235
Total sectors	78			1,378

As in the earlier cases, we must be prepared to use the first digit of each sector to represent a (QI). Therefore we have the following result:

4.5.1 Census for Boundary Condition 3

With three digits as the boundary condition for the number of digits in an (AIN) of order 1, the number of sectors available is 78 and the number of (AIN) available is 1,300.

4.6 Consolidated Census for Array of Order 1

Max N of Digits	N of Sectors	N of (AIN)
1	6	100
2	24	400
3	78	1,300

4.7 Allocation of Sectors for Array or Order 1 In [1p1]

It can be seen from the tables in sections 4.2, 4.3, and 4.4 that each sector is denoted by a symbol such as (S-A). (S-A) denotes the sector with (IN) A as its first (AIN).

Similarly, the symbol (S-ZA) denotes a sector with (IN) ZA as its first (AIN).

Again, (S-ZZ1) denotes the sector whose first (AIN) is ZZ1.

The following table shows a convenient allocation of the sectors in any (P).

Sector		To accommodate in (P)
(S-a)	..	(CPI)
(S-za)	..	(WI) – that is (I) in a [P3]
(S-z1) to (S-zA)		($\overline{\text{WI}}$) – that is (I) in a [P2]
(S-1) to (S-ZA)		($\overline{\overline{\text{WI}}}$) – that is (I) in [P1]

It may be repeated that the first (AIN) in each sector should be normally reserved to represent the (QI)— that is, the first characterstic on the basis of which the (I) to be accommodated in the sector are to be derived. An illustration is given for the (BC) 'Highway Engineering'.

In sector (S-za), za represents the 'Organ of remove 2'.

In sector (S-z1) and sector (S-zA)

z1 should represent 'Organ of remove 1';
z2 should represent the (QI) 'By Organ (Vertical)';
zA may represent the (QI) 'By Organ (Lateral)';
zM may represent the (QI) 'By Organ (Longitudinal)'; and
zT may represent the (QI) 'By Organ (as in Traffic Engineering)'.

In sector (S-A), the (IN) A may represent the (QI) 'By User'.

In sector (S-ZI), the (IN) Z1 may represent the (QI) 'By Use'.

In sector (S-ZA), the (IN) ZA may represent the (QI) 'By Terrain'.

In sector (S-(A)), the (IN) (A) may represent the (QI) 'By Brand — that is, by such a thing as 'Trade name'.

4.7.1 Overflow Quasi Isolate

If the number of first characteristics – that is (QI) – exceeds 24. The remaining 54 sectors given in the table of sectors and (AIN) in Sec 4.5.1 for the boundary condition of 3 digits in an (AIN) may be brought into use. The particular (QI) of such sectors brought into use will depend upon the position of the train of characteristics started by it among those already scheduled.

4.7.2 Combination of Trains of Characteristics.

If the subject of a document presents a (CdI) made of (I) taken from two or more of the trains of characteristics, the component (IN) should be arranged in the sequence in which their respective trains of

characteristics stand arranged in the schedule. They should then be connected to one another with the (CS) hyphen (-) as prescribed by the (SID) for the Notational Plane. Unless the (BCN) is one digited, the (CS) comma (,) should be inserted after the (BCN). This means that the insertion of a comma (,) is necessary after all the (CCN) and in the case of (MCN) beginning with an Emptied Digit.

4.7.3 Levels of [P]

If the subject of a document involves facets of level 2 or level 3, the usual rules apply about the insertion of comma(,) between levels. If, however, level 2 alone occurs without level 1, it is enough if a single comma (,) is inserted between the (BCN) and [1P2]. The allotment of sectors to different levels of [P] in a round is so made that no homonym will be created while the contemplated helpful sequence of the resulting classes is secured.

4.8 Allocat ion of Sectors in Array of Order 2 or in Arrays of Higher Orders

Whether the facet is a [P], or a [M], or an [E] sector (S-a) in arrays of order 2 and above will be occupied by (ACI). Whether the other sectors of zone 1 can be used for (SpI) has not yet been decided. Even supposing they can be so used, it has not yet been decided how they should be utilised. But, all the sectors of zones 2, 3, 4, 5, and 6 can be used for the subdivision of the (AI) of array of order 1.

5 PROCEDURE FOR THE SCHEDULE FOR [1P1]

5.1 Number of First Characteristics

Find out by the blending of the speculative method and the pragmatic method mentioned in Sec 3.4, the various first characteristics to be used, for subjects likely to go with the (BC) under consideration. Let us denote them by the symbols (FP), (FQ), etc. (*See* Sec 6.1 for example).

5.2 Sequence of First Characteristics

Consider any two first characteristics at a time. By the application of the Principles for Facet Sequence, determine the sequence in which the first characteristic that is (QI) should occur in the array. It is found from experience that the Wall-Picture Principle proves sufficient in most cases. But, of course, one should cultivate the experience and sensitiveness necessary to apply this Principle. Suppose, we have fixed the sequence (FP) (FQ). Then fix the position of (FQ) by taking it in relation to (FP) and (FQ) successively. It can be easily seen there are three possible places for (FQ) that is, before (FP), between (FP) and (FQ), and after (FQ). If the decision is before (FP) and if the comparison of (FP) and (FR) is made first, there will be no need to compare (FQ) and (FR). But if by chance, we had begun comparing (FQ) and (FR) and we get the sequence (FR) (FQ) we should again compare (FR) (FP). We decide that (FR) should precede (FP). In other words, two operations will be necessary instead of one. With experience, one can develop this flair to arrive at the result with the least number of operations. The helpfulness of such a flair will be

realized when the number of first characteristics is large. (*See* Sec 6.2 for an example).

5.3 Allotment of First Characteristics to Sectors

After the sequence of first characteristics is established, each first characteristic should be allotted to a sector. The sequence of the sectors so allotted should be parallel to the sequence established for the first characteristics as prescribed in Sec 5.2.

5.4 Telecoping in Array

The (I) based on the first characteristic represented by the first (AIN) of the sector should be found out by blending the speculative method and the pragmatic method. Then the (I) should be arranged in a helpful sequence with the help of the appropriate principle found among the Principles for Helpful Sequence [19]. Then each (I) should be allotted an (AIN) in such a way that the sequence of (AIN) is paralel to the sequence of the (I) already determined. In relation to the first (I) of the sector, the other (I) belong to the array of the next order as viewed from the Idea Plane. In fact, they form array of order 2. Allotting these (I) to the (IN) in the first order array as suggested above amounts to telescoping the array of order 2 into the array of order 1. If some of the (IN) of the array of order 1 are left unused, an attempt should be made to use them by the telescoping array of order 3 into array of order 1. This requires judgment. This will be illustrated in the later articles of this series.

5.5 Economy in Notation

The examples in the later articles will show the great economy in notation secured by this way of utilising the mixed notational base and sector analysis in CC. The economy in notation pervades not only [1P1] but also [1P2] and [1P3]. This is the result of the allotment of sectors made in Sec 4.7.3.

5.6 Comfort to Eye and Memory

Experience shows that the need to further subdivide the (AIN) in a sector is only occasional. Even if it is necessary, one step of sub-division may prove sufficient. This will prevent the full (AIN) not to exceed three digits – that is, the optimum number of digits for the comfort of the physiology of the eye and the psychology of the memory mentioned at the International Conference of Libraries and Documentation Centres held in Brussels in 1955 [20]. When a (CdI) is necessary, each component will also lie within this optimum limit and will get separated by its neighbouring components by a hyphen (-), thus giving relief to the eye and the memory.

5.7 Sum-up

To sum up, the design of classification, in respect of [1P1], for the subjects going with a specific (BC) consists of the following seven successive steps:

1. Determination of the possible first characteristics to be used as (QI) in the Array of Order 1;
2. Determination of a helpful sequence for the chosen first characteristics in the Array in the Idea Plane;

3. Allocation of the first characterstics to their respective sectors in the Array, in the Notational Plane;
4. For each of the first characteristics, construction of the provisional schedule for the isolates of all the necessary orders;
5. Classification of a variety of nascent micro documents by the provisional schedule, as a pilot project;
6. Finalisation of the schedule in the light of the experience gained in the pilot project; and
7. Additions and amendments to the schedule from time to time.

6 LONG PERSISTING CONFUSION

Till a few months ago, a confusion persisted in the Idea Plane. This was due to the spell caused by the new experience with the concept of (FC). Here is an example of such a spell. Consider the commodity 'Wooden Compasses' for use in drawing large figures on the black board. This term was taken to be a composite term. It was split into 'Compasses' and 'Wood'. The entity 'Compasses' was taken to belong to [P]; and the entity 'Wood' was taken to belong to [M]. Stated in words, the facet formula was taken to be:

[Compasses]; [Wood].

Consider a subject such as 'Breakage of Wooden Compasses'. Stated in words, the facet formula will then be:

[Compasses]; [Wood] : [Disorder] [Breakage].

The above may be represented in symbols as follows:

[1P1] ; [1M1] : [1E] [2P1].

This sequence would make 'Disorder' pertain to 'Wood' and not to 'Compasses'. Stated in general terms, the [1E] [Energy Isolate] would pertain to the [1M1] (Material Isolate) instead of to [1P1] (Commodity Isolate). This has been giving trouble for some years. During the last few months, the trouble has been traced to the initial error of looking upon 'Wooden Compasses' as a composite term and breaking it into a 'Personality Term' and a 'Matter Term.'

6.1 Removal of Confusion

It is now seen that the term 'Wooden Compasses' as a whole should be taken to be the Personality Term. To put it in other words, in classifying the universe of entities in [P] consisting of compasses, we can use the material of which the entity is made as a first characteristic – that is a (QI). On the basis of this first characteristic, we can get (I) such as:

1 Wooden Compasses;
2 Steel Compasses;
3 Aluminium Compasses; and so on.

Thus the material is not taken to be a manifestation in [M], but only as a means of identifying a commodity – that is, and (I) in [P]. Similarly, in classifying the universe of entities in [P] consisting of compasses, we may use as a first characterstic – that is a (QI):

1 Length of the arm;
2 Writing material attached at the end of the arm (such as inking compasses, penciling compasses, and chalking compasses);
3 Nature of the head joint of compasses; and so on.

Each such first characterstic will become a (QI) in the array of order 1 in [1P1]. This has already been mentioned in general terms in Sec 5.1.

6.2 Sequence of (QI)

As stated in Sec 5.2, the sequence of the (QI) in the array of order 1 can be determined by the Wall-Picture Principle. Let us assume for the time being that their sequence will be as follows:

1 Writing Material at the end of the arm (Purpose);
2 Material;
3 Length of the Arm; and
4 Nature of the Head Joint.

Let us further suppose the following to form part of the Schedule:

11 Chalking Compasses;
21 Wooden Compasses; and
37 Eighteen Inches Compasses.

Then the following (SII) are possible in [1P1]:

11-21 Wooden Chalking Compasses.
11-21-37 Eighteen Inches Wooden Chalking Compasses.
11-37 Eighteen Inches Chalking Compasses.

7 GAP DEVICE

In the design described in this series of articles, dependence on leaving gaps among (CN) or (BCN) or (IN) to provide for interpolation is reduced considerably.

7.1 Library of Congress Classification

The dependence on leaving gaps is greatest in LC. Its (CN) are all integers. Therefore, gap has to be left between two consecutive used integers to provide for 'Hospitality.' Any single gap has to provide for both Hospitality in Array [11] as well as Hospitality in Chain [12]. Sooner or later this leads to mix up of co-ordinate and subordinate classes within one gap. Further, whatever be the forethought with which the length of the gaps might have been decided, in course of time it happens that some gaps get choked up and make the scheme unfit for any further hospitality, while some other gaps get filled up very sparingly.

7.2 Decimal Classification

One lasting service of DC is the introduction of Decimal Fraction Notation. This takes care of subordinate classes and provides unlimited Hospitality in Chain [12]. But its limited base often makes an array of classes get completely filled up and unfit to give any more Hospitality in Array [11]. But when the number of classes in an array is smaller than the length of the base – less than 10 – DC notation can use the gap device to provide for Hospitality in Array[11]. But the gap is always small, if at all it exists and it gets choked up very soon.

7.3 CC Till Ed 6 (1960)

The notation of CC uses the Decimal Fraction Notation throughout and thus secures unlimited Hospitality in Chain [12] among (BC) and in each facet. Its Sector Device makes it possible to secure an unlimited Hospitality in Array [11] among (BC) and in each facet, in so far as extrapolation is concerned. But so far as interpolation is concerned, till ed 6 (1960), CC notation had to depend upon gap device with all its limitations. However, the very large base, with a length of 100 (if only one digit is allowed in an (AIN), of 400 (if the maximum number of digits is allowed in an (AIN) is 2, and of 1,300 if a maximum of 3 digits is allowed in an (AIN)) delays the choking up considerably. But, all the same, choking may appear and it does appear.

7.4 CC In 1963

After the postulation in 1963 of the concept of Emptying Digit and of the possibility of a digit being both Empty and Emptying, for example, U, W, Y, and Z [9], the sole dependence on Gap Device for interpolation of new (AIN) has now been obviated.

7.5 Threatened New Invasion of Gap Device and CC In 1964

In Sec 5.2 and 6.2 we saw the possibility of the array of order 1 of [1P1] having several (QIN) representing the respective first characteristics on which the universe of entities can be divided to yield the scheme for [1P1]. Suppose we have identified a certain number of first characteristics – that is (QI) – at the time of designing the Scheme *for* Classification. Suppose also that a few other first

characteristics – that is (QI) – are brought forth by newly emerging documents. These will ask for their respective places among the already existing (QI). In other words, need will arise for interpolating new (QIN) among the already existing ones in the array of order 1. All the economy and the elegance, got by allotting the different sectors and by telescoping in array the isolates based on them, would be lost if the Emptying Digits are used to carry out interpolation as prescribed in Sec 7.4. Therefore one is forced to have recourse to Gap Device in allotting the different (QI) to the different sectors in the array. In other words, some intermediate sectors will have to be left fallow at the time of designing. This danger is obviated and hospitality among the (QIN) can now be made as large as we like by bringing into use a three-digited (AIN) for interpolation between two consecutive two-digited (AIN). For example, if we have already brought into use the sectors (S-91) and (S-9A), we can interpolate between them the three sectors (S-99a), (S-991), and (S-99A). As and when need arises, we can provide any degree of Hospitality in Array [11] by increasing the maximum number of digits in (AIN) to 4, 5, and so on.

8 PLAN FOR FUTURE WORK

8.1 Versatility of Notation

We have thus got a very versatile notational system. It looks as if it can implement any finding whatever in the Idea Plane. It has taken nearly forty years to sense and harness the potential versatility of the mixed notation of CC and bring it into active use. It is the failure to have realized this that has been responsible for the delay in working

out Schemes *for* Classification – that is the schedules for all possible facets likely to go with a (BC) in 'Engineering', 'Chemical Technology', and 'Useful Arts' in particular and in any (BC) in general.

8.2 Frozen *vs* Growing Depth Classification

The present pace of industrial development all the world over caused by the current population pressure calls for the maximum conservation of the research potential of the world. This requires documentation work and service in respect of nascent micro-thought necessary as a Supporting Set-Up of Remove 1. In its turn, this requires the design of depth classification as a Supporting Set-Up of Remove 2. In documentation work, the depth classification has to organize not the universe of the frozen micro-thought of the past but with an extremely turbulent and fast developing universe of nascent micro-thought.

8.3 Differentia Between Training of Documentalist and of Generalist Librarian

Therefore, it is not sufficient if a documentalist is trained merely to use frozen, published Schemes *for* Classification. But he must be trained to design new Schemes *for* Classification and to extend them from time to time in a consistent way. Thus, the training of a documentalist has to differ essentially from the training of a generalist librarian in the public or academic sector. The training of the documentalist should include training in applied research in depth classification.

8.4 Training in Applied Research in Depth Classification

Continuing applied research in the design of depth classification by documentalist working in specialist libraries is now possible. This is so because the necessary fundamental research in the subject has now reached a stage when it can become the basis for applied research. As usual the quantity of applied research and the number of persons required for it will be far greater than those for fundamental research. Moreover, applied research is best done by persons working at the point of service. The training being given in the DRTC is turned on this fact. Documentalists with experience are also welcome to work in DRTC for short periods to get oriented to applied research of the kind mentioned above.

8.5 A Passing Mood of Despair

The Schemes *for* Classification of applied subjects available till now have been improvised rather superficially. Their roots do not run deep enough to make them stand the challenge of the new developments in the universe of nascent micro-thought. They had been put up *ad hoc* to meet the exigencies of the moment. They therefore break-down frequently. This frequent break-down has even thrown some documentalists into despair, made them question even the very utility and applicability of classification to the retrieval of micro-thought, and driven them almost to the point of abandoning classification. Some seek refuge in the possibility of subject heading giving the necessary service. This leads to failure sooner or later as the depth of the micro-thought increases. Some others try to escape

into machine retrieval. These would hand over the retrieval work to electronic engineers, and rest on their oars saying as it were "No more bother for us; the engineers will do all that."

8.6 Sight of Recovery

However, a few are beginning to realize that the machine can do the work efficiently only if a considerable prior classificatory work is done by the library profession. Further, machine retrieval is not likely to become viable for many years in an individual library or even in a group of libraries. Retrieval of micro-thought and of the organization of micro-thought needed for this purpose will have to be done by the documentatlist working in specialist libraries attached to research centres and industrial enterprises. They will have to depend on an efficient depth classification kept continuously up to-date by applied research. This means that applied research in depth classification by the documentalists in each specialist library is a necessity. This means that applied research in depth classification by the documentalists in each specialist library is a necessity. This is the reason for the DRTC training documentalists not only in the conventional methods of documentation work and service but also in the design of depth classification for diverse subjects.

8.7 Estimate of Work to be done

It is estimated that modern industrial and research requirements call for the design of a Scheme *for* Depth Classification for each of about 5,000 (BC). To carry out the necessary applied research in this

field, intimate knowledge is required not only of the latest methods in the design of classification but also of the developments in the wave-front of knowledge in the respective (BC). Thus, this applied research in design is best done by the documentalist working in libraries specializing in the respective (BC). This will be a continuing process. But the initial setting up of the basic scheme for each (BC) may take about a year. Thus 5,000 man years will be needed to cover all the 5,000 (BC). DRTC solicits the co-operation of the documentalists all the world over in getting the initial basic scheme for the diverse (BC) established as quickly as possible.

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Note:- 1 The following is the list of the documents used.
2 Column 1 gives the S N of the respective documents.
3 Column 2 gives the number of the Sec in the text, containing the reference
4 Unless indicated otherwise, the author of the document is S R Ranganathan.

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